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The Engineering and Mining Journal

MAY 13, 1911.

The Price of Lake Copper in 1910

With the exception of the Calumet & Hecla nearly all of the Lake producers report annually the amount and proceeds of their sales of copper. The official data for 1910 are summarized in the subjoined table:

SALES OF LAKE COPPER, 1910

Company	Pounds Sold	Receipts	Av. per Lb.
Ahmeek.....	9,574,512	1,244,603	12.99
Allouez.....	3,582,241	454,416	12.69
Centennial....	1,249,763	204,778	13.12
Copper Range.	42,468,754	5,407,629	12.74
Franklin.....	1,254,428	167,192	13.33
Isle Royale...	5,958,931	755,517	12.68
Mass.....	1,321,885	165,303	12.50
Mohawk.....	11,412,066	1,493,816	13.09
Osceola.....	16,744,258	2,184,083	13.04
Quincy.....	22,517,014	2,974,086	13.21
Tamarack....	10,039,970	1,301,798	12.97
Victoria.....	586,941	71,900	12.26
Totals.....	126,710,763	16,425,122	12.96

The average of 12.962c. per lb. officially reported for the sale of 126,710,763 lb., is to be compared with the quotational average of 13.039c. reported by the JOURNAL. A comparison for a series of years appears in the following table:

LAKE COPPER AVERAGES

Year	Pounds Reported	Average Realized	Quotational Average
1905.....	82,372,955	15.597	15.699
1906.....	113,411,645	19.146	19.616
1907.....	66,316,025	18.043	20.661
1908.....	125,949,248	13.348	13.424
1909.....	136,005,773	13.221	13.335
1910.....	126,710,763	12.96	13.039

In 1910 the several companies as usual showed a considerable variation in their individual averages, with the Quincy as usual realizing the highest, barring one small concern. The Quincy figure is, however, exaggerated a little by the inclusion of its silver receipts.

Development of Mines

During the year ended Dec. 31, 1910, the United States Smelting, Refining and Mining Company received 684 separate mining propositions. Mr. Sidney J. Jennings, the vice-president in charge of the exploration department of that company, reported that an examination of the reports submitted, together with a knowledge of the districts in which the properties were situated, was sufficient to warrant the rejection of 514. On 124 properties a preliminary examination was made by his engineers, with the result that no further work was recommended to be done on these properties. On 46 properties, on which a preliminary examination had been made, further work was recommended, and a complete examination of these properties was undertaken, with the result that two properties were reserved for further consideration, and it is hoped that satisfactory terms can be arranged for their purchase during the coming year.

The above data, which are in line with the experience reported by other exploration companies, are illuminating as to the nature of the mining projects that float around in the hope of interesting capital. In the present case of an important company, maintaining a well organized department for the investigation of mining enterprises, only two out of 684 proved sufficiently attractive to command serious consideration. The question of greatest interest, however, is what proportion of the remaining 44 upon which exploratory work was recommended might have been taken up if they had been presented upon satisfactory terms. One great factor that retards the development of new mines is the unreasonable ideas that are maintained by their owners.

The Peirce-Smith Basic Converter

It is interesting to note that the Peirce-Smith basic converter, concerning the operations of which we present a further paper in this week's JOURNAL is partially a new outgrowth of the steel industry, as was the original Manhes' acid converter. Basic converting along orthodox copper lines was by no means untried when the problem was attacked by Messrs. Peirce and Smith. The ordinary converter had been lined with basic brick and tried both without and with added silicious flux, the former giving what was char-

acterized as an "indescribable mush of copper and iron oxides," while the latter, although charges were successfully blown to copper, was abandoned, owing to trouble with the lining; or, in certain cases, smoke troubles caused the abandonment of all operations at the experimenting smelteries.

The first step toward the present large basic converter was the Peirce-Smith tilting-reverberatory furnace, a close prototype of which was found, it is said, in the tilting reverberatory at Steelton, Penn. This was a large cylindrical shell with ends like frusta of cones, externally fired. In adapting this to the copper industry a row of tuyeres was added and the regenerators dropped, so that the original copper-tilting furnace was a huge cigar-shaped converter lined with magnesia brick, and with an external firebox. In this, cold mattes and silicious flux were charged, melted and bessemerized. Profiting by the experience with this furnace, the present type of Peirce-Smith converter was evolved. The ends were squared, the throat removed from the end and placed on top and the firebox omitted, which was a further step from the original steel furnace toward the ordinary copper converter. Now, as seen by this week's article, others have again taken up bessemerizing in the ordinary type of barrel converter, so that it will be of interest to note which of the two types will survive, the basic-barrel converter, or the Peirce-Smith type. It is a matter of interest that the original copper-tilting reverberatory is still standing, but is now idle, it is understood, because of "smoke farmers" in the vicinity.

Fine Crushing on the Rand

The most interesting feature, in recent years, of Rand metallurgy is the development of heavy gravity stamps and increasing use of tube mills. It has at last been realized that fine crushing in the battery is not essential and although the duty per stamp has been increased to 20 tons and more by crushing through coarse screens, there is considerable doubt as to the economy of the heavy stamp as a preliminary crusher.

Amalgamation is done after grinding in the tube mills and it has been found that such mills are capable of taking a much coarser feed than was previously thought economically possible. Now, from the Geldenhuis Deep and East Rand Proprietary mines, where much experimenting has been done, comes the report that the metallurgists there are beginning to doubt whether the heavy stamp rightfully should occupy the exalted position they have been prone to give it.

Reducing in one stage seems to be a hobby on the Rand, and if any of the intermediate grinders, so much used in this country, have been installed there, little mention of it has been made. Judging from previous Rand tendencies we may expect that a general recognition of the fact, that the heavy stamp is not all that it was supposed, will be followed by an era of tube-mill development to attempt to make that machine an efficient slimer of a coarse feed. To what limitations in size the tube mill is restricted, we hesitate to say, but in a prophetic spirit predict that the question will be investigated on the Rand within a few years.

Stage crushing by rolls has been thoroughly tried out in this country with success in mills crushing a great daily tonnage. One result of such development was to emphasize the need of an intermediate grinder, especially in concentration plants—a grinder such as the chilean or Huntington mill—and possibly the slow-speed roller mill will be found to fill this requirement satisfactorily.

Questions and Answers

A little while ago a subscriber to the JOURNAL asked us, in a letter, a question, to which we replied that he would best obtain the desired information by inserting an advertisement in the paper. If he had reflected a little, this idea would probably have appealed favorably to him, but he did not stop to think and wrote to us, rather indignantly, "Why, I thought you promised always to answer questions."

We do indeed answer questions of general interest, without any reference as to whether the inquirer is a subscriber or not. There is scarcely any limit to the pains that we will take in such matters if the interest be sufficiently broad. An inquiry may reveal the demand for information that many of our readers want, and that is exactly what we are anxious to furnish. That, in fact, is our function. Furthermore, we will answer any special inquiries, just to be obliging, out of the spirit of mutual coöperation that is necessary in everyday life, if we can do so readily.

But we cannot undertake to give advice on matters that really call for the professional service of an engineer, chemist or geologist, nor can we undertake special investigations merely to bring buyers and sellers together. Our advertising pages are available for that purpose and are the most economical medium.

A considerable demand for copper is promised by the recent action of the Prussian diet appropriating the money required to change the State railroad from Magdeburg to Leipsic from steam to electric power. The work is to be begun at once, the construction of the necessary power houses being the first step. The change will cover 360 miles of line; moreover, according to the minister of railroads, it is the beginning of the electrification of the entire State system. In England it is proposed to electrify the London, Brighton & South Coast road.

The troubles between R. T. Bayliss and S. Pearson & Son over the Mexico Mines of El Oro, to which we referred several months ago, developed into an action for libel brought by the former against the latter upon the ground of a letter written to the secretary of the mining company. This action has lately been settled by the defendants stating publicly that while criticizing the conduct of the plaintiff as chairman of the company they did not intend to make any imputations on his personal honor or character. As we remarked previously, the treatment of Mr. Bayliss was outrageous, and it is gratifying that his opponents have at last made what in effect is an apology.

Notwithstanding the brave words of the leading interests, there are not wanting signs of a coming break in steel prices. The question seems to be whether there will be a general reduction like that made in 1909, or whether there will be a gradual crumbling away, to be tardily and grudgingly recognized. The latter process seems to have already begun with some of the lighter lines of steel products, and such movements sometimes acquire impetus rapidly.

Metallics

Expansion of pipe lines is often taken up by using occasionally a length of pipe bent in a circle with large radius.

In driving keys for cast-iron pulleys, drive lightly until the key is tight; then give just one smart blow with a light hammer.

A well made canvas belt will outlive two rubber belts in hot, damp places, if occasionally treated with the dressing provided by the belt manufacturers.

An alloy is a solution of one or more metals in another that is in or has been in the molten state, and regardless of any separation that may take, or may have taken place, upon cooling.

In the use of mercuric chloride as an antiseptic, if a 5 or 10 per cent. solution of common salt be used, the mercuric chloride will dissolve more rapidly, and 1:2000 or 1:3000 solutions will not sting.

The air-valve handle of hammer drills is made of cast iron so that it will break easily if a miner uses a wrench to turn a stiff valve. Formerly steel handles were used, which proved so tough that valves were injured before the handle became deformed.

One or two gills of kerosene fed to a boiler daily with the feed water will sometimes loosen scale and permit its being blown off. This treatment kept up for a few weeks has been known to loosen completely a thick deposit of scale on the tubes of a locomotive-type boiler.

When a rock breaker is used intermittently it is preferable to use an auxiliary pulley rigidly mounted on the end of a short shaft supported by two blocks, than a loose pulley. When a loose pulley is carrying the belt for long intervals of time the bore rapidly becomes enlarged by wear.

When it becomes necessary to tighten the belts frequently, and it is found that grinding machinery does not run satisfactorily unless the belts are right, the trouble can generally be remedied by changing the position of the drive shaft so the pull of the belts comes at an angle more closely approximating the horizontal. A vertical belt must be kept taut but a flat belt may run slack.

The most difficult slime to filter by leaf filters is that free from fine sand and derived from oxidized clayey ore. After 40 min. vacuum such slime formed a cake only ⅜ in. thick, containing 3.46 lb. of dry solids per square foot. Slime from average oxidized ore will form a 1¼-in. cake in 25 min., carrying 8 lb. per sq.ft. A slimed sulphide will form a 2½-in. cake weighing 18 lb. per sq.ft. Rand slime is considered a perfect slime free from sand and is practically a pure clay, but a 3-in. cake can readily be formed.

By the Way

The following is not a Chinese puzzle but the caption of a paragraph from an English contemporary: "Loading and Unloading of Cages—Under this head are included: Keps, fallers, or pillars; winding men or minerals from mid-insets; barriers; persons riding against full tubs, or with gear; additional outlet for persons." The puzzle is to find the key to this code.

A Wall Street man, according to the *Evening Post,* was in a Fifty-seventh Street shop where artists' materials, such as paints, brushes, canvases, etc., are sold, and by force of habit he asked the owner of the shop how it was with him. "Business is very bad," said the shopkeeper. "The artists are not selling anything, and, of course, that reacts upon us. I do wish the Supreme Court would hand down those trust decisions."

Men have passed through literature of a sort to Wall Street, says the *Evening Post,* but instances of their passing through Wall Street to literature of another sort were until recently very rare. Lawson was the first to demonstrate that it could be done. The practicability of it will doubtless mitigate the sorrows of going bankrupt with other people's money in Wall Street. No more need the bankrupt sneak into Wall Street with an aching stomach after 5 o'clock, when everybody is gone, and stare at the windows where his name was once spelt large in gold letters. He passes to greater fame. He engages to write the story of his sordid career—to tell in detail how he got the people's money, what he did with it, and how foolish they were to let him have it.

The professor of political economy in one of our great Eastern universities says: "The production and consumption of coal in this country are probably more nearly equal than is the case with the production and consumption of any other of the great staples. Only about 3 per cent. of the product of our coal mines is at present exported." It is not our present output so much as our capacity to produce that interests us. We could produce this year 100,000,000 tons more coal than we will consume. This fact alone is conclusive evidence that the coal industry is one business where the market price of the product is not inflated. Modern business practices may have set aside the law of "supply and demand" in some industries, but this law is operating 24 hours per day in the coal business. When consumption is equal to productive capacity, then coal men will sit up and take notice.

A large copper manufacturer remarks that "Conditions in the copper market cannot be expected to improve until the policy of excessive output stops. The failure properly and scientifically to gage the situation has yet to be learned, but the tardy recognition of the necessity for constructive work to promote confidence in copper cannot be much longer delayed without reaping the inevitable consequences. If the market is to be saved from a more serious setback, the production fervor must be restrained." This savors of the recent remarks of Mr. Fielding. Their views are sensible no doubt, but they do not take into account the present conditions. There are a lot of new men in the copper business, who have acquired some wonderful mines at comparatively small cost in the first place and are now anxious to realize their enormous profit. They have no real intention to continue as producers of copper. They are mining especially for the stock market. Hence the huge, unnecessary increases in productive capacity. They will be a disturbing factor in the copper business until they have distributed their stocks. Then some of these companies may become as conservative and intelligent as the Calumet & Hecla and P. D. & Co.

Weary promoters returning from Porcupine, says the *Evening Post,* complain of the tremendous rise that has taken place in the costs of promotion; also, of its being a rich man's game in Porcupine. Claims are held at prices never dreamed of before. The owner of a claim sits receptively around on the very high places and waits for business. He does not seek the New York promoter; the promoter seeks him, and is warned to be respectful. He asks the claim-holder if he knows of anybody who has a claim to sell. The claim-holder admits that he does; in fact, he has one himself that he will sell. After some sparring, the New York promoter asks the price. It is $350,000. "Oh," says the promoter, "I'm not after a mine. I want a claim only—a prospect." "That's it," says the claim-holder. "That's what this is—a prospect. Never was a pick in it." The New York promoter passes on. The next one is $400,000, and another is $600,000, and they are all prospects. The option on such a claim, with 10 days allowed for examination, costs $10,000 and up. What is a poor promoter to do? Nearly all promoters are poor. If he thinks of raising $10,000 for an option, on the gamble of being able to buy the claim later, he is next confronted with Canadian mining laws, which are so much more prejudicial to promotion than the American mining laws that he begins to be discouraged, indeed. Presently he comes back, reporting, as has been said, that people in Porcupine are crazy, and it's a rich man's game. Imagine paying several hundred thousand dollars for a claim! A claim sufficing as the base of $5,000,000 capitalization ought to cost only a few hundred dollars. Prospects in Porcupine cost more than mines in Nevada.

Correspondence and Discussion

Prevention of Miner's Phthisis

The following resolution has been adopted at a recent meeting of the board of directors of the National Association for the Study and Prevention of Tuberculosis:

Whereas, the Royal Commission, appointed by the Governor-General of Australia, to inquire into the subject of miners' lung diseases, has ascertained a truly alarming state of affairs resulting from the extensive use of rock drills under ground, not provided with spraying apparatus to diminish the production of health-injurious dust, and:

Whereas, a large proportion of our mining population is exposed to conditions quite similar to those reported upon adversely in the Australian commonwealth, and:

Whereas, the actual extent of the occurrence of lung diseases among metal miners in the United States is at present unknown:

Resolved, by the board of directors of the National Association for the Study and Prevention of Tuberculosis, that we recommend to the President and the Congress of the United States that a thorough investigation into the whole subject of the sanitary conditions surrounding metal mining underground, with special reference to diseases of the lungs, be made by the U. S. Bureau of Mines, the Public Health and Marine Hospital Service, and the appropriate State authorities.

FREDERICK L. HOFFMAN.

Newark, N. J., May 4, 1911.

The Flotation Processes

In the editorial entitled "The Flotation Processes" in the JOURNAL of April 15, 1911, it is stated that the Zinc Corporation in installing "the so called Minerals Separation process" at Broken Hill, has reverted to a process which in all its essentials was described by Miss Everson in her patent which has since expired. As a final summary American millmen are assured that the patent situation "need not bother the *bona fide* user of a good but old metallurgical method, providing he does not infringe some special apparatus which the Zinc Corporation has proved to its satisfaction, to be quite unnecessary anyway."

It is fair inference, I think, from all of this, and the rest of the editorial, that American operators would be safe from actual infringement of valid patents if they installed such a flotation process as the Zinc Corporation has installed.

Entirely aside from the fact that the article as a whole is misleading, inasmuch as it fails to give a proper idea of the relative importance of the processes referred to, and is erroneous as to facts; and entirely aside from the fact that the Zinc Corporation is operating under license from Minerals Separation, Ltd., and is paying royalties for the use of the process, there are certain aspects of the patent situation that are pertinent to the JOURNAL'S assurances to American millmen. The Minerals Separation, Ltd., owns a string of about 15 patents taken out in the United States, Canada and Mexico, and has a number of applications pending. These are for processes, for apparatus, for improvements on apparatus, and for specific reagents.

The Zinc Corporation's installation and its operation is, *prima facie*, covered by a number of these patents. Therefore, if an American operator installed, without a license, a flotation plant like that of the Zinc Corporation, he would *prima facie* be infringing certain of the Minerals Separation patents.

The Minerals Separation, Ltd., has had competent legal advice and is satisfied that its patents will be sustained by the courts, and is determined, therefore, to carry any infringement proceedings it may have to initiate through to the court of last resort. EDWARD H. NUTTER.

New York, May 5, 1911.

Views, Suggestions and Experiences of Readers

Dust and Gases in Mine Air

In the JOURNAL of Jan. 21, it is stated that in Western Australia the expectation of life of the average miner is 3½ years less than that of an ordinary laborer; probably the conditions there are no worse than in other parts of the world.

Some mines, I notice, are providing comfortable change and bath rooms for their miners, but why not go a step further and improve the conditions under which they work?

The objectionable features of a mine atmosphere are excessive moisture, dust and carbon dioxide. The first is sometimes due to water seepage, but a considerable quantity is carried in with the compressed air. Would it not be advisable to dry the air before passing through the compressor?

With reference to dust, a water spray is sometimes used with more or less success, but this is liable to cause the air to be saturated with moisture, and, where the workings are hot, the result is anything but exhilarating. Would it not be better to scatter salt about? This would absorb some of the moisture and so keep the dust wet and prevent its rising. It has been stated that when calcium chloride was used, sulphates in solution decomposed it, but this would not happen with salt.

As regards carbon dioxide (a heavy gas which is liable to be about the floors of workings and in drives, winzes, etc.), it seems to me that fan ventilation is only a partial remedy. Considering that the gas is exhaled from the lungs, and that also one pound of blasting gelatin is stated to produce nearly 3¾ cu.ft., the quantity distributed through the underground air must be considerable. Though the presence of even 1 per cent. is not fatal, the effects are distinctly perceptible. Could not some cheap material be provided that would absorb the carbon dioxide and perform the function of plants on the surface, and so take it out of circulation? It may be objected that carbon dioxide has never been found in appreciable quantities in any but coal mines, but has it ever been looked for?

Perhaps the miner will say, if the candle will burn the air is good enough for him, but let him stand for awhile with his head near the ceiling of a room lighted by gas, and he will find the air there anything but pleasant.

AUSTRALIAN.

Sydney, N. S. W., March 31, 1911.

The Quebec Mining Law

The statements made about the Quebec mining law, under the caption of Toronto, page 780, JOURNAL of April 15, are incorrect. I was the discoverer of molybdenite and silver at Keekeek and since 1901 have had claims there so that conditions are well known to me.

In regard to the staking law, $10 will buy a license which will allow one to stake 200 acres and which is valid for four months, after which time the staker is compelled to take out a mining license, the fee for which is $10 and $1 additional for each acre staked. This license holds the claim for a year.

The staker has to do 50 days' work every year for 10 years or forfeit the claims. In other words, he is compelled to apply for a patent, paying $10 per acre or, if 20 miles or less from a toll road the price is $20 per acre.

J. C. MACKORMACK.

Pembroke, Ont., April 18, 1911.

United States Smelting, Refining and Mining Co.

The United States Smelting, Refining and Mining Company, operating in Utah, California, Mexico, Indiana and New Jersey, has just issued its fifth annual report. Although conducting such widely scattered operations, practically every subsidiary was interfered with during the year in an unforseen manner. At the Centennial-Eureka mine in Utah the installation of a pumping plant forced a prolonged shutdown. Developments on the Bullion Beck & Champion Mining Company's property were unsatisfactory; the Mammoth smeltery, in California, was provided with insufficient baghouse capacity and ran only two furnaces most of the year; power at Pachuca, Mexico, proved to be insufficient; the Eureka & Palisade Railroad, hauling ore from the Richmond-Eureka mines, Utah, was washed out; the Needles (California), plant was suffering from the throes of reconstruction and development; and the refineries at Grasselli, Ind. (lead), and Chrome, N. J. (copper), had an insufficient supply of bullion.

In spite of this, 7 per cent. was paid on the preferred stock, 4 per cent. on the common, the usual depreciation charges were provided for, and $79,665 added to the surplus, which now amounts to $1,794,895, and the general outlook for 1911 is good. The ore reserves at Bingham were said to be larger on Jan. 1, 1911, than on Jan. 1, 1910, and high-grade copper ore was encountered near the close of the year. At the Centennial-Eureka mine the ore reserves were kept undiminished, while at Pachuca power conditions are now favorable and developments were such that work has been commenced on a duplication of mill capacity. At Mammoth it has been found possible to operate three furnaces; Grasselli operations are said to be more satisfactory than before, despite reduced tonnage; Chrome has a satisfactory copper supply; and good ore supplies are being contracted for and developed in the camps around Needles, beside which the new concentrator and electrostatic zinc plant should help out that smeltery.

The total earnings of all the companies were $3,738,541, from which $1,067,069 depreciation and $187,154 legal and administration expenses were provided for, leaving a net profit of $2,484,318; dividends of $2,404,653 were paid, leaving a balance to be carried to surplus of $79,665. The metals produced in 1910 were: Copper. 28,430,425 lb.; lead, 51,450,985 lb.; silver, 10,776,465 oz.; gold, 113,246 oz.; their values bearing the following respective percentage ratios: 25.90; 16.33; 41.14; 16.63. The average prices received were: Copper, $0.12828 per lb.; lead, $0.04478 per lb.; and silver, $0.54003 per oz. Mine production of the subsidiaries was 777,355 tons, the metals being distributed by value in the proportion 40 per ent. copper; 6 per cent. lead; 36 per cent. silver; and 18 per cent. gold. In an accompanying table is given a condensed consolidated balance sheet. The most striking changes

U. S. S. R. & M. CO. BALANCE SHEET
DEC. 31, 1910

	Assets	Liabilities
Cost of properties	$41,577,092	
Deferred charges	548,594	
Inventories:		
Ore and matte	728,255	
Supplies	1,382,056	
Metals on hand	3,848,787	
Notes receivable	806,642	
Accounts receivable	788,167	
Cash	1,417,884	
	$51,097,477	
Preferred stock		$24,313,700
Common stock		17,553,825
Subsidiaries' stock outstanding		1,043,549
Bills payable		2,149,240
Accounts payable, payrolls, etc.		752,328
Drafts in transit		260,158
Reserves for freight, etc.		346,047
Dividends payable Jan. 16, 1911		601,082
Depreciation and reserve		2,177,949
Undivided subsidiaries' surpluses		104,704
Surplus as at Jan. 1,1911		1,794,895
		$51,097,477

in the balance sheet are the increase of $1,062,730 in the cost of properties during 1910, and a reduction of $2,431,035 in the value of metals on hand. Total profits dropped from the 1909 figures of $3,136,360 to $2,484,318, and amount transfered to surplus from $727,526 to $79,664. The excess of current assets over liabilities now stands at $4,862,936.

The Tennessee Sulphuric Acid Plant

The sulphuric acid plant of the Tennessee Copper Company is of capacity for making about 200,000 tons of acid of 60 deg. B. per annum. In the last report of the company some valuable data as to this plant are given.

The plant was practically completed in the year 1910, and is rapidly being tuned up to capacity. The gas was first admitted to the new dust chamber in the latter part of June, and from that time on the production has rapidly increased as more chambers were put in service, and in December the production of acid was 12,175 tons.

The last chambers were put into operation Dec. 6. The chamber plant is completed, but there are still under construction two large Gay-Lussac towers which, when finished, will complete the largest sulphuric acid plant in the world. Some idea of its size may be obtained from the following list of materials used in the construction:

The foundations called for the excavation of 84,400 cu.yd. of earth and rock and the placing of 12,000 cu.yd. of reinforced concrete. There were 7,220,000 lb. of iron and structural steel erected for the framework; 900,000 ft. of lumber was used for concrete forms, etc.; 140,000 sq.ft. of roofing was put in place; 50,000 sq.ft. of asphaltum was put in for flooring under the chambers; 1,346,000 chemical brick, 270,000 fire brick and 2,210,000 red brick went into the flues and connections; 7355 tons of quartz was used in the packing of the towers; 550,000 lb. of asbestos was used for insulating the flues, and 7,830,000 lb. of lead was used in the construction of the plant.

The manufacture of sulphuric acid from smelter fumes was not the simple work that it was at first thought, but has required a great deal of new and original chemical research work, the success of which is shown by the present output of the plant.

The California Conservation Commission

SAN FRANCISCO CORRESPONDENCE

The appointment made by Governor Johnson of the three men forming the Conservation Commission created by the Legislature should be satisfactory to the entire State, not merely because of geographical considerations, but from the fact that the appointees are men of broad views and extensive experience. Dr. George C. Pardee, former governor, of Oakland, represents the central part of the State, Ralph W. Bull, of Eureka, the north, and Francis Cuttle, of Riverside, the south. The commission will serve without compensation. Their duties will be to direct the investigating and gathering the data concerning forestry, water, the uses of water, water power, electrical and other power, mines and mining, mineral and other lands, dredging, reclamation and irrigation; these data to be compiled and published as a basis for revising, systematizing and reforming the laws of this State pertaining to these subjects. The commission is given power to employ expert and other assistance; and is authorized to make all necessary surveys and measurements of land and water in the State. The duties of the commission extend to the examination of the laws of the United States and of foreign countries, and the reports and recommendations of persons, officials and societies and commissions respecting the subjects investigated. The appropriation for this work is $100,000. The investigation is to be completed within two years. In its relation to mines and mining, and minerals and mineral lands, this investigation has a broad scope that may be profitably considered. The conservation of minerals and mineral lands in California, and the regulation and control of the mining industry, particularly respecting the petrolific occurrences and products, and the minerals derived from streams and lakes, have attracted but small interest until recently. The legis-

lature just adjourned has made some effort in the right direction regarding the minerals contained in the waters of the State, and has provided for inspection of quartz mines and mills, though ignoring other mine operations; the conversation of natural mineral gas was provided for. But there is a deal of careful, systematic work to be done in behalf of the mining industry by the new Conservation Commission if the laws of the State relating thereto are to become of permanent value to investors.

Prize for a New Copper Recovery Process

The German mining papers contain the following announcement: "Patrons of the Royal Prussian Mining Academy at Clausthal have placed the sum of $250 at the disposal of the corps of professors for the purpose of awarding a prize to the best solution of the following problem: The utilization of ores poor in copper, rich in silica, and containing lime and magnesia." Explanatory to this, it is given out that extensive ore deposits exist containing from 60 to 80 per cent. SiO_2 and considerable amounts of calcium and magnesium carbonate (10 to 30 per cent.) and copper in quantities varying from 2 to 12 per cent., partially as sulphide but predominantly as carbonate, for the utilization of which no commercial fire or wet method is known at present. Proposals will be received for the utilization founded on personal experiments, calculations of costs, etc. Particulars may be obtained from the director of the Mining Academy. The theses must be written in the German language and filed with the director of the Mining Academy not later than April 1, 1912. The announcement of the result will be made on or before July 31, 1912 and published in the *Zeitschrift für das Berg-, Hütten-und Salinenwesen im Preussischen Staate, Glückauf, Metallurgie,* and *Zeitschrift für angewandte Chemie.* Rumor has it that the object of the above offer is to get a working method for the Otavi ores.

A Freiberg Anniversary

At the request of a number of graduates the authorities of the Bergakademie, at Freiberg, in Saxony, have decided to celebrate each year, about Whitsuntide, an "Old Freibergers' Day," in the old mining town. The program for the present year provides for a welcome meeting in the hall of the Bergakademie in the morning, followed by a general inspection of the buildings and collections of the mining school. After lunch there will be informal receptions, reunions, etc., followed by a supper in the evening.

All graduates and former students are invited to attend. Those who can do so are requested to send notice to the secretary of the Bergakademie at Freiberg not later than May 20; together with the sum of 6 marks—$1.50—to cover the incidental expenses.

Sale of the Risdon Iron Works

The control of the Risdon Iron Works of San Francisco passed to the United States Steel Corporation by deed dated May 1. The Risdon company has furnished many of the western mines with milling and mining machinery, but the dredges at Oroville and elsewhere and the Risdon hoists are probably the best known products of the works among mining engineers.

The site of the company's plant is at Potrero. The consideration includes a $600,000 mortgage to the Mercantile Trust Company of San Francisco. The actual price probably amounts to $1,000,000 or $1,500,000 exclusive of the mortgage. All manufactured products in hand and accounts due are excepted. Present enlargement of plant or extension of manufacture is not probable, according to reports.

Utah Copper Company

The report of the Utah Copper Company for the quarter ended March 31, 1910, shows net profits from milling operations for the quarter of $787,936; income from Nevada Consolidated, $375,187; miscellaneous earnings, $11,385; total, $1,174,508; from which dividends of $1,171,987 (7½ per cent.) were paid, leaving a net surplus for the quarter of $2521. No depreciation was provided.

The total production for the quarter was: January, 6,707,116 lb.; February, 7,329,326 lb.; March, 7,260,267 lb.; total, 21,296,709 lb., compared to 22,188,719 lb. in the previous quarter. Costs were 8.344c. per lb. in the quarter under review, as compared with 8.227c. per lb. for October-December, 1910. The increased cost is explained by a decreased tonnage and the mining of more ore underground because of winter conditions. The tonnage treated was 981,104 tons, and the grade of ore, 1.55 per cent. copper. All copper produced has been sold, and on March 31, the copper dues to nearly the middle of May had been sold.

The Magna plant was in continuous operation, the Arthur plant was only operated to take the excess tonnage over the capacity of the Magna plant. The first remodeled section of the Arthur plant went into operation in February. Another has since started, and a third is ready to run. The reported recovery in these new sections is over 70 per cent., and for the quarter, the extraction in both plants was 69.98. It is stated that with the new Arthur plant in complete operation that the extraction will considerably exceed 70 per cent.

The construction of the Bingham & Garfield Railway is nearly completed and it is now expected that it will begin operation about July 1, 1911. All of the heavy grading and tunnels on the line have been finished with the exception of some unimportant details. One of the steel bridges has been completed and the other two are in process of erection and all but about three miles of the track has been laid. Delivery of equipment with which to start operation is promised in the latter part of June.

Nevada Consolidated

The report of the Nevada Consolidated Copper Company for the quarter ended March 31, 1910, shows 7½ per cent. dividends paid, depreciation charges of $136,883 met on the Steptoe smeltery, and a net credit to profit and loss of $126,466. The copper production was: January, 5,268,954 lb.; February, 4,992,533 lb.; March, 5,632,256 lb.; total, 15,893,743 lb., compared with a total of 15,698,595 lb. for the preceding quarter. Ore treated averaged 1.84 per cent., and the cost per pound of copper, including Steptoe depreciation, was 6.99c. per pound.

Stripping has been continued in the Liberty pit, and 8½ acres have been partially stripped, involving the removal of 334,230 cu.yd. of overburden. The pit is now in such shape that about 1000 tons of ore per day could be mined from it if required, and it is the intention to extend operations until 2000 tons per day can be mined when necessary to supplement the Eureka pit output.

An investigation of oil firing for the Steptoe reverberatories was undertaken in November, 1910, and on March 9, 1911, one furnace was changed to oil. The others will have made the change to oil by July, it is expected. Basic-lined converters are being installed, and No. 1 should be in operation early in May; Nos. 2 and 3 in July.

New Aluminum-Copper-Tin Alloy

A new aluminum-copper-tin alloy, consisting of about 78 per cent. aluminum, 8 per cent. copper, and 5 per cent. tin, has the following advantages: It can be easily and economically cast; the castings are homogeneous, free from dross, of such density that they need not be subjected to pressure; can be finished without a lubricating agent, and the finished object has a beautiful lustrous appearance. The copper contents of the alloy, according to the *Mining Journal,* may vary between 7 and 8.5 per cent., and the tin between 4.5 and 5.5, but in any case the percentage of copper must exceed that of the tin.

Details of Practical Mining

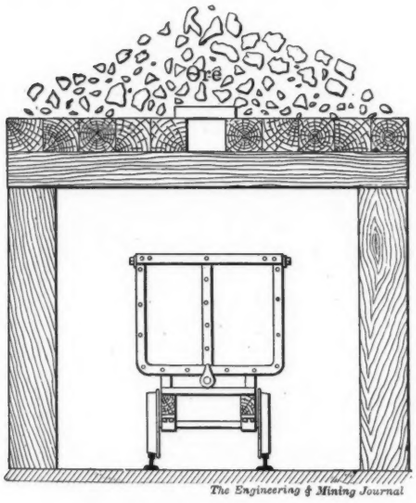
This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Handling Ore in Narrow Square Set Stopes

By Frank R. Edwards*

While mucking at the Pennsylvania mine, in Butte, I became acquainted with a cheap method of handling ore in narrow square-set stopes. The main drift having been driven the desired distance and a raise put up, overhand stoping was



Handling Stoped Ores

at once started from it, going toward the shaft. Before a blast, heavy shooting timbers were placed on the sets and tightly blocked except for a space of seven or eight inches running lengthwise of the stope, which was covered over on top of the timbers with foot lengths of 2-in. stuff laid crosswise. A few shovelfuls of ore was placed on these and then the round blasted. When the miner had worked down his back the mucker brought in his cars, placing them under the first "stoppers" to be pulled, and with the pick filled the cars as fast as they could be run under. Any large boulders were broken with an 8-lb. hammer.

*Mining engineer, Rosiclaire, Ill.

Concrete in Inclined Shafts

By Sheldon Smillie*

When a well organized, well advised mining company commences to sink a shaft, the question of durability of equipment outweighs that of first cost, and for this reason concrete has in some places gradually superseded timber for supporting the walls through the overburden. Its long life in wet shafts and its freedom from the danger of fire especially commend it. For use in vertical shafts through water-bearing ground it has been employed for some time, but only recently has it been applied to metal mining and inclined shafts.

Concrete Collars and Runners

In the Lake Superior copper region all new shafts are equipped with concrete collars. Concrete runners under the rails have not yet gained the popularity they deserve, but are coming into use more and more. The collar or cribbing makes an absolutely water-tight joint with bedrock, keeping out all surface water, is free from rot and should a fire occur in either the shaft or in the rockhouse above, large iron doors may be closed to make an effectual barrier.

Managers have installed concrete runners experimentally and in a critical mood have found absolutely nothing to complain of except that a fast-moving skip makes much noise. It was thought that with rails laid rigidly on the concrete there would be considerable breakage from crystallization, but this seems not to be the case. In my opinion, if it had proved a source of trouble, both the breakage and the noise could be eliminated by inserting a strip of wood between the rail and the concrete. The strip could be replaced without much trouble when rotten, and would furnish little combustible material in event of fire. The only real objection ever made was that if a skip went off the track it would either break the runners or would become so tightly wedged that the runner would have to be broken to get the skip out and valuable time would be lost making forms and allowing new concrete to set. This might happen with small, poorly balanced skips, but in a period of four years at one of the largest mines of the district, where a hoisting speed of 4000 ft. per minute is usual, I do not recall a single derailment.

The accompanying sketches show the usual designs employed. In preparing for the collars the shaft is carried down to firm bedrock, the size of the outside dimensions of the concrete, the temporary lining making the outside form for the concrete. When sufficiently firm ground is reached, the size of the shaft is contracted to its regular dimensions, forming a ledge upon which the concrete is started. The inside form need only be built high enough to give the concrete at the bottom a good set when the lower frames may be moved above. The collar can be built to any hight required by dump facilities and tracks.

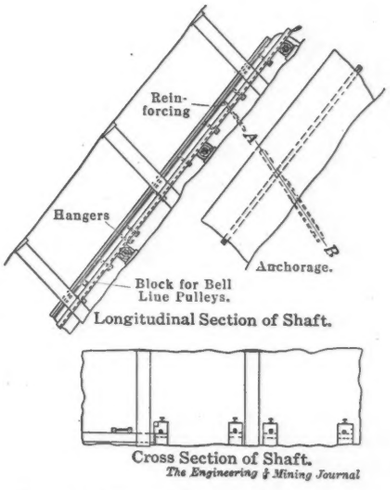


Fig. 1. Sections of Inclined Shaft

The walls are proportioned according to the depth of the shaft, the concrete mixture and whether or not reinforcing is to be used. When well reinforced on the hanging-walls with old rails, rope and the usual collection of old iron found around a mine, 12 in. is probably the minimum thickness. To make the cribbing water-tight, care must be taken that the ledge is clean, the concrete well tamped, and when left over night should be left rough and well wet the following morning. For this purpose a fire hose attached to the column-pipe will be found convenient. In filling in the concrete a chute is all that is necessary for shallow work, but if the fall is too great the sand and rock tend to separate and the con-

*Mining engineer, Box 233, Aspen, Colo.

crete should be lowered into place. When first finished the ground water appears to seep through and below the cribbing, but this stops in time, due probably to clogging of the pores of the cement.

If considerable water is running when the cribbing is installed it may be necessary to drain in some special way and stop the holes later with plugs. In the cribbing the dividers and runners are built at the same time as the walls. The dividers between the compartments are concrete posts normal to the dip about 1x2 ft. in section and spaced 6 ft. centers.

The dimensions of the runners vary with the type of skip and may be square or battered; 12x12 in. is a good section. One mine has runners 14 in. high with a 14-in. face and 16 in. wide at the base. The first rails are anchored by straps to the runnners of the rockhouse and are held in place on the concrete at intervals of 3 ft. by a pair of cast-steel clips, cast to fit the flange of the rail. Through the clips ¾-in. bolts, heads up, pass through ¾-in. galvanized pipes set in the concrete, terminating in No. 20 galvanized-iron boxes, 3x4x12 in., which are laid transversely in the runner. The box permits the insertion of a washer-plate and nuts. Some companies use bolts with threads at both ends, but this makes tightening difficult, especially if one nut goes on hard and the other easily, and the threads are apt to wear on the upper end with any motion of the rail. Square heads and nuts are preferable as offering greatest purchase for a wrench and least wear. For tight places bolts are made with hexagonal heads as they can be manipulated more readily. Old galvanized-iron pipes cut to proper lengths for the bolts were found to be cheaper than having special tubes rolled and made a part of the box. A piece of old 3-in. pipe laid outside the runner permits the bell rope to be extended into the shaft house, and a piece of old hoisting rope forms a good core for supporting the runners.

Extending Runners above Surface

In finishing the top of the collar, provision must be made for attaching the runners of the permanent rock house. In the case illustrated in Fig. 2, the rock-house was to have a channel section to which wooden runners would be bolted. Long 2-in. bolts were to be placed at the proper distance at the side of each runner; these would lie between angles riveted back to back on the back of the channel and the bolts would tighten down on a washer-plate at the upper end. If doors are to be hung over the shaft a 1-in. length should be made all around each compartment by thinning the walls by that amount, and the necessary holes for bolts and lock provided for. An opening is left at the side of the ladderway to admit the air and water pipes from conduits or ditches.

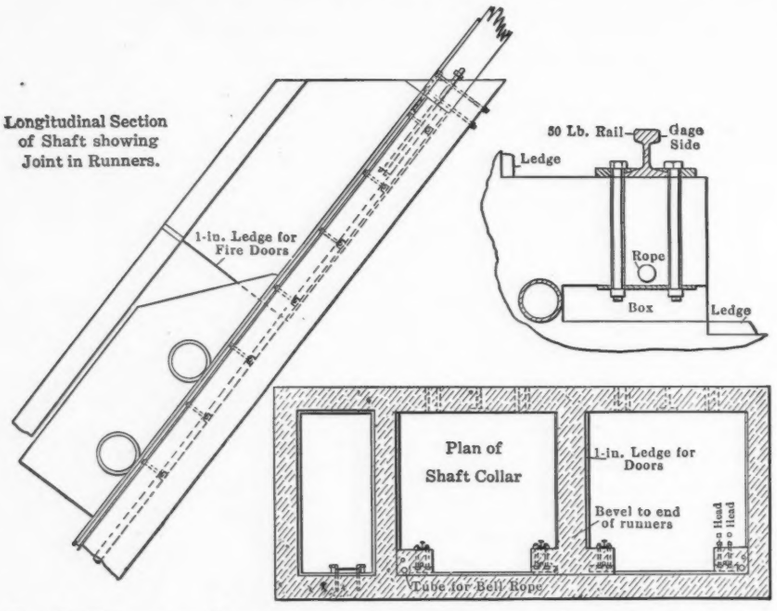


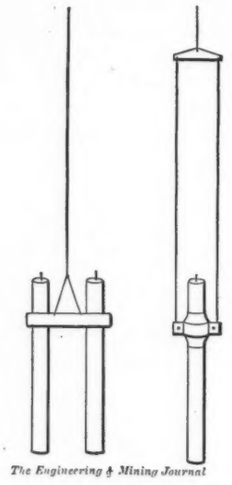
Fig. 2. Details of Connection of Concrete Shaft Runners with Wooden Runners of Rock House

The hanging-wall of these mines needs little or no support, and the runners for the rails are built directly on the footwall of the shaft, saving room that has hitherto been given to cross ties. They are similar to the runners in the collar, but usually a little higher to allow for the irregular footwall. The adhesion to the footwall is usually neglected, and an anchorage made of drill steels are set at intervals in the footwall to carry the entire weight of the runners.

In steeply inclined shafts the outer ends of the drill steels are supported by tie bolts from ring bolts set in the footwall a few feet above. Tie bolts set at intervals in the concrete outside the rails support the rails by a long hanging bolt bent at the lower end and passing through the web. The guide sheaves for the ropes are supported on structural-steel cross pieces from runner to runner laid in the concrete. Pulleys for the bell rope are screwed into wedge-shaped rocks set at convenient intervals in the side of the runer.

Mapping Open Stopes

When old open stopes are in part or wholly inaccessible the only practicable method of exploring and measuring them is by lowering lighted candles. The accompanying drawing shows a simple scheme for securing the candles. The clamps holding the candles can be made of sheet iron bent as in an ordinary miner's candle stick. Wire should be used for the part of the supporting line that is liable to be burned by the candle flames.



Method of Suspending Candles

Such lights can be lowered in various parts of a stope if the upper workings are accessible, then by measuring angles with a Brunton and noting horizontal distances between points of support, an approximate mapping of the stoped ground can be effected.

Gate Valves for Battery Pipes

By C. W. Walker*

In the Journal of April 22, 1911, under the head of "Metallics," it is stated that batteries, wet-crushing machines, concentrating machines and tables should be provided with both plug and globe valves. Experience has taught me that a gate valve is always preferable to a globe valve in mill work.

Globe valves give trouble from dirt, trash and moss accumulating under the

*Millman, Miami, Ariz.

seat, which makes removal of valve necessary for cleaning, while with a gate valve the dirt passes through when fully opened.

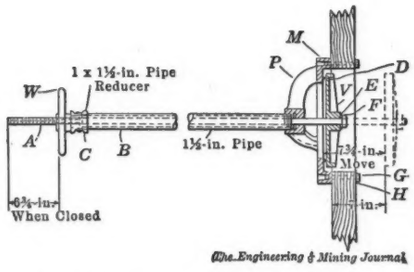
It is better to use as small a valve as will give the required amount of water under the lowest pressure, for a small valve almost fully opened is less apt to be clogged than a larger one only partly opened.

Gate for Leaching Vats

The North Star mills, at Grass Valley, Cal., are using a discharge gate for leaching vats that has proved satisfactory in operation and cost of maintenance.

Refering to the sketch, *M* is an annular casting bolted to the floor of the vat. Provision is made for calking filter cloth tightly. A tripod *P*, cast integral with *M*, serves as a guide for the valve-stem and a support for the operating mechanism. The lower face of *M* is machined and forms the valve seat. A groove is cut in the valve seat and a piece of round rubber packing *D* is fitted in place as a gasket.

The valve gate *V* is held in place on the stem by a nut and packed against leakage along the stem by rubber gasket



OLIVER SAND-VAT DISCHARGE GATE

E, and cut washer *F*. The valve stem *A* of sufficient length to reach above the surface of the charge, is made from ⅞-in. square wrought-iron bar, and is threaded at its upper end. It passes through a square opening, in the hub of the tripod, the upper portion of which is enlarged and threaded to take a standard pipe 1½-in. diameter. A piece of pipe somewhat shorter than the valve stem is screwed into the tripod, and capped by a reducer at its upper end. This reducer *C* serves as a bearing for the operating handwheel *W*, running on the thread *A* of the stem.

This gate is moderate in first cost and can be made in any foundry. It opens away from the charge, the gate dropping 7¾ in. below the valve seat, which has an internal diameter of 10 in., thus providing ample discharge area. All troublesome guy wires are eliminated and the operating mechanism is above the charge. This gate was designed by E. L. Oliver, and is not patented.

Mine Dust Prevention on the Rand

BY E. M. WESTON*

There are two types of dust arresters in use on the Rand, one being merely an arrangement to trap the dust in a wet sack and the other adopting the old suction principle. That designed by Doctor Aymard belongs to the first class and the other is known as Pursers'. The government, the mine owners and to a certain extent the miners have begun to realize the terrible loss to the community and to the industry in the destruction of the skilled-laborer supply and the life, moral nature and efficiency of the miners that is caused by unhealthy conditions in mining. Of these the worst effects as regards health have been caused by the gases produced by the explosion of 1-lb. explosives per ton of rock broken in the mines of the Witwatersrand and more particularly by the dust produced by blasting, by rock drilling in upper holes and by shoveling.

With regard to the first, many mines are introducing fans which improve ventilation, and as the law provides that water shall be laid to the face of every drive, sprays on the principle of James' water blast can easily be used to cool the air and absorb much nitric peroxide and CO_2 gas from the explosion, while at the same time all the dust caused by explosion should be laid with ease especially if a few such sprays be arranged in the drives leading from the top of stopes.

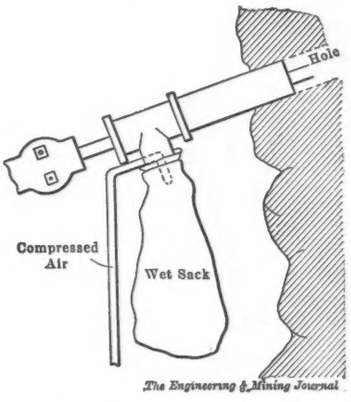
The law now insists that before blasting and during drilling of dry holes the walls and roof of the drive shall be damped with water to cause the precipitation of dust. This is a hint American mines might well take but though good in itself all mines should have water supplied in pipes to all faces and a proper spray be turned on after blasting. Reading between the lines of the account in the JOURNAL of Feb. 11, 1911, of the demands made by the miners of Butte, one can only conclude that in certain districts of America mistaken notions of economy are doing as much harm and causing as much loss as they have done on the Rand. No wonder the native American miner is deserting the deep mines of his own country. Turning now to the dust produced by shoveling, the mining regulations lay down that water must be available in all stopes in pipes and all broken rock must be damped before shoveling.

DRILL SPRAYS NOT LIKED BY MINERS

With regard to dust from drilling uppers with either piston or hammer drills, most miners refuse to use a water jet to kill the dust in the hole, but lately I have met a few miners here who are using water jets in raises. The general complaint is that owing to the splash and drip, it is pleasanter to die of phthisis than of rheumatism. Sprays affixed to the machine have never been popular here, as they increase the humidity of the air greatly and do not lay more than 70 per cent. of the dust. Leyner drills or any hammer drills working with hollow steel are not in use, though I think the improved Leyner drill using hollow steel bits in one piece may yet find a place here for certain work. When a fair sized mine like the Nourse blunts 27,000 drill bits a week the question of maintenance of hollow steel is a serious one. I can say that at present there is no serious attempt being made on this field to destroy the dust in the hole itself when boring dry holes.

PURSERS' DUST ARRESTER

Many attempts have been made to design an apparatus that will collect all the dangerous dust at the mouth of the hole. Mr. Remeaux of France has recently done some work on the subject. It is comparatively easy to design a device that will collect the dust, but the trouble is to



PURSERS' DUST COLLECTOR

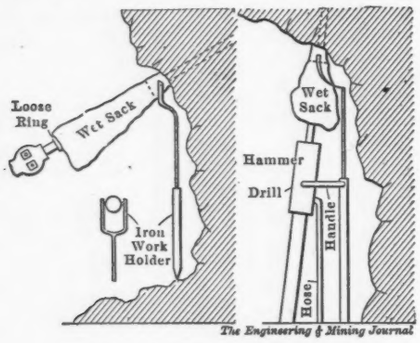
design something that will not detract from the efficiency of the work and will not hinder the men, or take too long to adjust. Pursers' dust arrester consists of a short length of piping of such a size at one end and perhaps split so that it can be driven into the mouth of the hole formed by the starter drill bit. To the outer end is fixed a T-piece with the opening pointing downward and to this opening is fixed a reducing piece and an air cock and small air jet to act as an injector and on the end is a wet bag or a pipe opening under water. The idea being that after the hole is started the pipe is driven in and the air connection made and the suction of air will draw in the dust. There are several disadvantages connected with this device: (1) It involves the use of a certain amount of air and, as the ordinary ¾-in. hose in use does not supply a 3¼-in. drill with sufficient air as it is, it thus hinders drilling. (2) It could not be used in a steep hole as the dust would fall past the opening.

*Mining engineer, Box 1176, Johannesburg, S. A.

(3) It involves the use of an air hose about the feet of the drill tender, a "spanner boy," where it is sure to get damaged or in his way in removing drills from the chuck.

Aymard's Dust Collector

The construction of Doctor Aymard's device and its use with hammer and piston drills is shown in the sketches. A conical ring, which can be made by riveting sheet iron (or better by a drop forging out of a piece of weldless tubing) is hung by two trunnions in the yoke of wrought iron which is connected with a bar sliding in a tube which can be clamped in any position by the set screw shown. Over this ring is sewn a bag of jute sacking of the shape shown and with a piston drill the other end of the sack is supported by a loose ring which slides on the drill bit. With a hammer drill the bottom of the bag is tied round the drill steel. This apparatus takes, of course, some small trouble in fixing, but I believe it to be a practical device and might be adopted in many American mines with advantage



Aymard's Dust Collector

where the hammer drill has already earned the unenviable name of "widow maker." The miner if he wishes to, can make a good use of this device which costs only £1 to make, and it will pay miners to install it. The sacking is, of course, kept damp to settle and collect the dust. I have heard it said that the bag is liable to catch the chuck of the machine in work but this is easily guarded against with care. On the mines of the Rand, the only real objection to their use with piston drills is that where three drills are used in one face, there is no room for their use; but on one of the large mines the other day quite a number of these devices were shown that had been wilfully damaged by the miners to avoid using them.

A New Respirator

The new miners' phthisis compensation act will have one good result as it makes it in the interest of the mine owners to secure as many convictions as possible against their workmen for breaches of the act, as three convistions render a miner ineligible for compensation. Doctors Aymard, Moir and Mitchell have designed a new respirator on the baffle principle which has great advantages over the old style though Dr. Hildick Smith holds that the best respirator and one which can be worn while working hard is a thin sponge covering the mouth while the nostrils are stopped up. The mask of the new respirator is of ordinary design and of soft, light, cool leather, such as undyed sheepskin preferably faced on the edge with rubber. The mouth is about 1½ by 2 in. and consists of an aluminum or zinc box in which are three screens set parallel to one another a little distance apart. The center one is of antiseptic lint so cut as to leave an open slot about ¼ in. wide down the center. The other screens face this on opposite sides and are made of perforated zinc or aluminum with a covering of lint on one side (the inner). Practically there is a narrow door with a screen on either side making the air take a zigzag course. These screens can be taken out and cleaned and damped, and experiment has shown that they arrest practically the whole of the dust leaving any remainder to be dealt with by nature's arresters in the nose and mouth. One can blow through them or take in a deep breath past them without difficulty and they also should have a sphere of usefulness. Some have been given out to natives who use and appreciate them. I believe silicosis in mines to be a preventable disease today and when public opinion all over the world is sufficiently aroused it will be eliminated from mining risks.

Laying a Magnesia Furnace Bottom

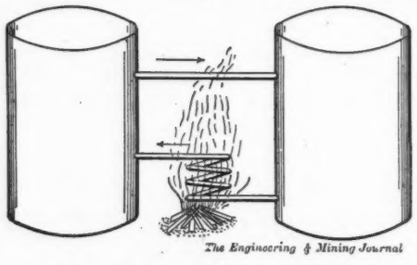
The accompanying description of the furnace bottom and method of laying same in the 15-ton electric steel furnace at South Chicago was given at the meeting of the Chicago section of the American Electro-Chemical Society. With small changes the method is available for nonferrous furnace bottoms.

The furnace shell is of plate steel, 1 in. in thickness, riveted together. The outside horizontal cross-section plan is approximately that of a complete circle of 13½ ft. in diameter, with two flattened portions situated at the front and back respectively. On the bottom of the furnace, within the 1-in. plate, and next to it, one row of magnesite brick laid the 4½-in. way is placed across the flat portion. The side walls of the furnace are vertical and consist of two rows of magnesite brick laid the 9-in. way, giving a thickness of 18 in. of magnesite brick. These solid magnesite brick walls extend up to the furnace roof. The bottom proper of the furnace consists of dead burned Spaeter magnesite to a depth of 12 in. at its thinnest point, which is, of course, at the extreme center. From this thinnest point the bottom slopes gradually upward so as to form a portion of a sphere 7 ft. 2 in. in radius.

This bottom was fixed in the following manner: Dead burned and carefully ground Spaeter magnesite was mixed with basic open-hearth slag in the proportion of four of magnesite to one of open-hearth slag. To this mixture enough tar was added to make the mass sufficiently plastic to enable it to be tamped into the furnace in the usual manner. The entire depth of the bottom was tamped in this way. Next the furnace was filled with wood, dried out for about 48 hours, and then filled with coke and the electrodes lowered and the current turned on. In this way the bottom was fluxed into place.

Heating Water for Concrete

The accompanying sketch illustrates a simple arrangement for heating water on small jobs of concrete work in cold weather. The scheme was originally used by E. L. Jones of Nelson, Ill., and described in a recent number of *Popular Mechanics*. Two barrels are placed about 6 ft. apart and connected with



Apparatus for Heating Water

pipe as shown. The pipe used may be any size from one to two inches in diameter, with three or four coils in the lower pipe. Water is poured into the barrels and a fire built under the coil. As the water runs through the coil it is heated and passed into the other barrel hot and ready for use. A complete circulation is maintained so long as the water is higher than the upper pipe.

Cause of Mine Fatalities

Examination of the Idaho State mine inspector's report for 1910 shows that there were 12 fatalities for the year, with 6000 men being employed. Seven deaths were due to falls of rock, two to explosions of blasting compounds, two to falling down chutes, and one to electrocution. In the last eight years there have been 126 fatalities in Idaho, of which 33.3 per cent. have been caused by falls of rock; 23.3 by explosions of blasting compounds; 19.9 by falling down chutes; 5.5 by hoisting accidents; 4.8 by electrocution; 4.8 by car accidents, and 8.4 by all other causes.

A mixture of flake graphite and grease is recommended to prevent adhesion of screw threads by rusting.

The Porphyry Copper Mines

By J. Parke Channing *

A review of the discovery of the so-called porphyry copper mines. Their equipment a matter of great expenditure, which must all be written against operating costs within a determinable period.

*Consulting engineer, 42 Broadway, New York.

NOTE—Excerpts from a paper read before the Finance Forum, May 10, 1911.

The term "porphyry coppers" is a popular one, which is today applied to that type of copper deposit in which the ore occurs as a huge mass of rock, through which is disseminated copper in various forms, usually as a sulphide. Strictly speaking, the expression "porphyry" is not correct, although in a majority of the deposits of this character the rock mass is an altered eruptive rock having the broad general name of porphyry. There is, however, no particular virtue in an eruptive rock, and in the case of two of the properties the rock is a schist almost identical with that forming the island of Manhattan. In both cases it has been intensely altered and silicified, so that only in patches would you be able to recognize it as the gray schist which outcrops in Central Park.

THE FIRST "PORPHYRY COPPER"

When it comes to priority, I should say that probably the first porphyry mine is that of the Arizona Copper Company at Clifton, Ariz. Clifton is an old district which produced copper from high-grade ores way back in the '70's. This ore was smelted and the copper hauled by wagon to the nearest railroad and shipped. Gradually, as the rich ore was exhausted, attention was called to the rock inclosing or contiguous to the veins, which was a soft, white material, somewhat friable, and having through it a sprinkling of black, which appeared more like a mere clouding of the otherwise white rock. This black was found to be chalcocite, or rich sulphide of copper, and a concentrating mill was built in which the material was crushed and enriched by wet concentration. The resultant mixture was then smelted.

It was my good fortune to spend three days in the early part of December, 1897, in the Clifton district, and the result of that three days' visit was of incalcuable value to me as showing what could be done with a material, which in the ordinary mine would be considered waste rock. Perhaps, however, my appreciation of the conditions here and the realization of what it meant was accentuated by the previous experience which I had at Lake Superior, where a rock containing but a small amount of native or metallic copper was treated at a profit.

My attention was next called, in about 1902, to the immense mountain of porphyry up Bingham cañon, in which Colonel Wall had driven an adit and which showed chalcocite mixed with pyrite. I was then in the throes of starting the Tennessee Copper Company, which is the lowest-grade ore in the world that is being smelted for copper alone, the resulting product containing no gold or silver. This was enough of a problem and I reluctantly found myself unable to devote any attention to Colonel Wall's showing in Bingham cañon. This was soon after taken up by D. C. Jackling, who worked out the best method of handling the ore in a small plant, and from it has developed the Utah Copper Company of today with its two enormous mills and its steam-shovel pits.

EARLY DAYS OF NEVADA CONSOLIDATED

In 1904, Messrs. Requa and Bradley had realized the advantages of the discovery made at Ely by Captain Grey, who had gone out into the middle of an apparently unpromising porphyry area, had sunk a shaft which at 120 ft. had suddenly plunged into disseminated ore carrying 3 per cent. copper. They took hold of the property, continued to develop it, and in the spring of 1905, most of the properties were brought together under what was known as the Nevada Consolidated Copper Company. Messrs. Requa and Bradley had prepared careful reports upon the property with the results from their preliminary mill tests, and the senior member of a prominent banking firm in New York volunteered to get all the money desired in Paris for the equipment of the property. He went to Paris, the reports were submitted to prominent bankers in that country, but as far as I can make out the engineers to whom the report was submitted had not kept up with the practice in America, and considered the proposition as entirely without value with no hope or possibility of ever making an ore pay which ran less than 3 per cent.

After the failure of the New York bankers to get any results in Paris, I was asked to make a report on the property, which I could readily do, and in which I predicted a cost of a trifle over 7c. per lb. of copper laid down in New York. On the result of my report the control of the property passed into new hands, the property was developed and equipped on a larger scale, and today Nevada Consolidated is producing copper at about the figures of my estimate.

THE DISCOVERY OF MIAMI

The discovery of Miami is almost a romance. In 1900 I had seen the Ray and had been told that its ore ran 3 per cent. and over. I had kept the property in view, and in 1906 I got an option on it from the London stockholders, and in December of that year examined it. The terms which the English proposed were not satisfactory in view of the fact that there probably was not over one-half million tons of ore developed, the grade appeared low, and so I gave up the option. As I had never visited Globe I engaged a team and drove over the Pinal mountains from Ray to Globe, a distance of 45 miles, which at that time took me 12 hours. The second day that I was in Globe I was approached by F. C. Alsdorf, whom I had known in Colorado many years before. He told me that he was conversant with the Clifton district, and that a similar type of deposit existed a few miles out from Globe. He said that he had a tentative agreement with some capitalists in Colorado Springs to submit anything he thought well of to them first, and that until they had turned down the proposition he could not show the property. Saturday night he came and told me that he had received a telegram from his people stating that they had no engineer to send and regretted that they had no one to look at the property. The next day, Sunday, he took me over the ground which is now the Miami and the Inspiration.

I was so favorably impressed with the surface indications that upon returning to the hotel I got hold of the principals in the property, and at two o'clock in the morning closed a deal with them by which I took an 18 months' option on the property, the first payment to be made in six months, with no money down. At that time there was not a single pound of ore visible at Miami, nor was there a pit anywhere over 10 ft. deep. We started in January, 1907, sunk two shafts upon the property; in May, No. 2 shaft struck ore at 220 ft.; by the first of June it was in the ore 50 ft. and two crosscuts at right angles were driven 30 ft. each way, and we felt that we were justified in making out first payment. I then went to Alaska, and when I returned in October a million tons of ore had been developed. From that time on development was rapid so that today Miami has nearly 20,000,000 tons of ore, covering over 50 acres.

In the meantime, the people from Colorado Springs took the Ray Consolidated

which I had given up, and as they were the people to whom Mr. Alsdorf had originally presented the Miami, by a strange coincidence, we traded properties as it were, and I who had started out with Ray got Miami, and they, who had first choice at Miami, got hold of Ray. This digression is perhaps personal, but it may be of interest to you as showing some of the inner and accidental workings in the acquisition of properties.

Extractable Ore

In estimating the total life and the present value of any of the "porphyry coppers," the total ore which it is expected may be extracted should be taken into consideration, the amount that is available for extraction by no means ever equaling the amount that is developed. It of course goes without saying that the lower the grade of the ore the larger amount one will have to leave in a mine, although if care be taken perhaps some of this may not be waste, but in later years may be treated. Certainly in handling the waste or tailing from the concentrating mill it is considered the best practice nowadays to store it, as the time may come when it can be treated. Although my conclusion has lately been criticized in the courts, I still adhere to my opinion that one of the best and most valuable assets of the Calumet & Hecla Mining Company is the 30,000,000 tons of tailings which by the foresight of the late Alexander Agassiz, was carefully deposited in the upper end of Torch lake, and which now, by modern methods, becomes valuable for the production of a large tonnage of copper.

You have access to all of the reports of the "porphyry coppers." Their statement as to tonnage and grade are as accurate as engineering figures can be, and you may make your own conclusions as to the value of the property. Roughly speaking, the grade of the ore varies from 1½ to 3 per cent., and conditions probably exist in which just as much money can be made from a ton of 1½ per cent. ore as from a ton of 3 per cent. ore. Regarding the tonnage developed, you can see that they run into the millions. It will take years to get them out, and it will cost millions to get them in shape to do so. The Miami, with which I am connected, and which has just now entered the rank of producers, has taken us four years and $4,000,000 to get into shape, and you will find in the case of the Nevada Consolidated, Utah Copper and Ray Consolidated that their expenditures have run up into the millions.

Cost of Equipment Should Be Written Off

To those who expect to buy an unfailing supply of copper at 10 or 11c. per lb., I can hold out no hope. There have been no new discoveries for several years, and while they may, and undoubtedly will be made, it will take time and many more millions to develop them. In figuring the real cost of the copper that must come from these porphyry mines, the cost of the plant must be considered as part of the operating expense. It is nothing more or less than operating expense paid as a lump sum in advance, because when the mine is exhausted, and in the case of the porphyries their end can be carefully figured, the plant becomes worthless, except for scrap iron.

Mr. Moreing on Porcupine

At a recent meeting of the Northern Ontario Exploration Company, Ltd., the chairman stated that the company was formed in January last with a capital of £400,000, in 400,000 shares of £1 each. Of these, 100,000 shares have been issued. The company was formed to acquire mining properties and to carry on generally the business of an exploration company, primarily, in the Porcupine district of northern Ontario. At the end of January, C. A. Moreing and David Richards, two of the directors of the company, went to Canada, accompanied by mining engineers. The Porcupine field was visited by C. A. Moreing and the engineers, and investigations made upon the spot. Negotiations were entered into with Messrs. Timmins, who owned a group of 50 mining claims known as the Timmins-McMartin group, which claims are believed to occupy some of the most favorable positions on the Porcupine field. As the result of these negotiations, one-half share of the whole of 50 claims was acquired by the company. Having acquired this interest, drills, compressors, boilers and other plants and stores were at once sent forward to the field, in order to take advantage of the facility of transport prior to the breakup. Camps were formed, and the erection of houses, stores, etc., at once proceeded with, as also active development work upon some of the properties.

The Various Holdings

There is a group of four claims at the end of Gillies lake, which is in a direct continuation of the Hollinger line of reefs, and on the south claim a wide vein has been uncovered, showing gold.

The claims known as the Miller claims are on the direct line of veins of the Rea Mines, Ltd. Veins showing gold have have been discovered on this property. At the extreme north there is a group of five claims, on one of which a large vein showing gold has been found.

There are three claims situated on the line of reef of the Dome Extension. There is also a block of 14 claims situated on what is known as the "Reserve." It is stated that several large veins have been uncovered on this group.

All the 50 claims have been selected because they have a showing of gold and veins of some sort on them. These 50 claims, thus jointly owned by Messrs. Timmins and the company, have recently been acquired by the Ontario-Porcupine Goldfields Development Company, Ltd. That company has been formed with a capital of £600,000, in 600,000 shares of £1 each, which are today being offered to the public for subscription.

The Hollinger Interest

Messrs. Moreing and Richards, while in Canada, also acquired on behalf of the company 50,000 shares in the Hollinger Gold Mines, Ltd., owning the well known group of Hollinger claims. A participation of 6000 shares at the cost price to this company has been granted to friends who assisted in the matter, thus leaving the company with a holding of 44,000 shares. The Hollinger Gold Mines, Ltd., is a company incorporated under the Ontario Companies Act, with a share capital of $3,000,000, divided into 600,000 shares at $5 each, of which 100,000 shares were reserved for working capital. The company owns four mining claims of 40 acres each (160 acres in all). The claims adjoin each other, and can thus be operated from one central plant. There are three veins outcropping northeasterly and southwesterly across the property, and on what appears to be the main vein are the present workings. The length so far uncovered upon the surface is about 1700 ft. The shaft has been put down 100 ft., and the level driven at that depth for nearly 1400 ft., the orebody varying in width from 4 ft. to 8 ft., and averaging over 2 oz. per ton gold. A winze from the 100-ft. level has been sunk to a depth of 100 ft., and at the bottom of the winze the vein is 7 ft. wide, showing free gold valued at over 2 oz. per ton. A 30-stamp mill with cyanide plant is now in course of erection.

Mr. Moreing's Remarks

C. A. Moreing said that he had recently paid a visit to the goldfields of Porcupine, and it was remarkable to his mind how erroneous were the impressions formed by people in England with regard to the situation of that district. The Porcupine goldfields were actually situated south of London by latitude, and were only 24 hours by rail from Montreal or Toronto, which were only seven days from London, so that consequently anybody could get to these fields from London in about eight days. Work could be carried on throughout the whole 12 months of the year, and as far as general climate was concerned, the place could be considered a health resort. The fields were situated not far south of the main line of the Grand Trunk Pacific, and the Government of Ontario is building a branch line into them, which would be opened for

traffic during the coming summer—certainly not later than the end of July.

It was only last summer that the discovery of these important gold-mining areas was made, and during the present summer a great expansion in exploratory work would take place, and he had not the slightest doubt that further discoveries would be made, which would attract a great deal of attention throughout the world. Up to the present, several phenomenal and important discoveries had been made. Thirty-six square miles of ground had already been pegged out by prospectors, and it was the company's intention to concentrate on Tisdale, because the most important work had been done there. The Dome mine was there, and when he visited that mine in January he had brushed the snow from the outcrops, and seen the gold glittering on the surface in the quartz, and he was told by the managers that they estimated the width of the face at 30 ft., all payable. They had put down a borehole, and cut the deposit at 400 feet.

The surrounding country contained numerous waterfalls, and these could be used for the supply of power to work the field. During the coming summer it was the intention to explore the best veins, and he supposed that they would then have to form subsidiary companies for the actual development. It was certain that in that district they had a goldfield containing rich ore, permanent in character, and likely to be brought very prominently before the world in the near future. They were sending out Doctor Maclaren to make a geologic study of this field, so as to give them a scientific basis on which to carry out their operations. He thought they might say that as far as the company was concerned everything was on a satisfactory basis and that there was no doubt that the Hollinger mine would be paying dividends before the end of the year.

New Method of Rolling Sheet Zinc

Ball Bros., of Muncie, Ind., have bought the zinc-sheet rolling mill of the Lanyon Zinc Company, at Laharpe, Kan., and are operating it under the name of the Laharpe Zinc Rolling Mill Company. At this plant an ingenious and highly successful system of rolling sheet zinc in strips has been developed. By this process zinc is rolled in strips 6 in. wide and 300 ft. long. Such a width is quite sufficient for the purposes of many manufacturers using sheet zinc, e. g., manufacturers of fruit-jar covers. The rolling of sheet zinc by the new process is considerably more economical than by the ordinary method, both in direct operation and in first cost of plant. Moreover, a relatively inferior grade of spelter may be successfully employed.

The Alaska Coal Claims

WASHINGTON CORRESPONDENCE

What appears to be the final stage in the history of the Cunningham coal claims in Alaska, which brought about the Ballinger-Pinchot investigation, has been opened at the Land Office. On May 8, attorneys for the Cunningham claimants, E. C. Hughes, of Seattle, and John P. Gray, of Wallace, Idaho, appeared for the claimants. The hearing was had before Land Commissioner Dennett and Secretary of the Interior Fisher, sitting with members of the Board of Law Review of the Land Office. It will be the duty of Commissioner Dennett to hand down the decision, but Secretary Fisher resolved to sit at the hearing so that in case an appeal should be made to him from the decision of Commissioner Dennett, time and expense would be saved.

The Cunningham coal-land claims, 33 in number, are so called because it was Clarence Cunningham, of the State of Washington, who, while in Alaska in 1902, discovered the coal which led to the filing of the claims by himself and 32 others. Opposition to the final granting of the claims was due to the charge that there was conspiracy to defraud the Government. L. L. Glavis, who wrote to President Taft charging former Secretary Ballinger with maladministration of the public-land laws, began an attack upon the Cunningham claims early in 1908. He asserted that through the assignment of the Cunningham claims "the Guggenheims" were about to be given a monopoly of Alaskan coal.

The Ballinger-Pinchot investigating committee filed two reports, the majority exonerating Secretary Ballinger and the minority sustaining to a large degree the allegations made by Glavis. No action respecting the merits of either finding was taken by Congress, and since the proceedings were directed chiefly against Mr. Ballinger, his resignation probably forestalls a congressional verdict. The majority of the congressional committee did not pass upon the merits of the claims, declaring only that "if they are regular patents they should be allowed." The committee said it found no reason to doubt that the commissioner of the General Land Office, with an appeal to the Secretary of the Interior, would decide the cases fairly and impartially.

Mr. Hughes, arguing for the claimants in the new proceedings, asserted that as they had paid the purchase price of the land, and held receipts from the Government for the money, this was equivalent to the actual delivery of patent rights. According to the Alaskan coal-land law of 1904, which, he declared, was complete in itself, as soon as a claimant had staked off his land and had entered it in the register's office he had a right to make contracts to sell such land, provided the claimant was not legally disqualified.

Asked by Secretary Fisher whether he had read the brief presented in behalf of Gifford Pinchot in connection with the charges in the case, Mr. Hughes declared that this brief was only partially correct. He did not believe there had been intentional deceit, but asserted that the facts had been "shuffled." He did not explain in what particular the brief was only partially correct.

American Institute Lecture

Jennings S. Cox, Jr., general manager of the Spanish-American Iron Company, lectured before members of the American Institute of Mining Engineers, on Monday evening, May 5, at the United Engineering Societies building, New York, on the subject of "Iron Ore Mining in Cuba." Mr. Cox referred briefly to operations at Daquiri, on the south coast, but devoted most of his time to the less known but extensive deposits near the north coast, where 3000 million tons of soft hematite ore are reported in the Mayari, Moa, Taco and Navas districts. Mr. Cox's lecture was particularly interesting by reason of his account of the way in which the difficulties met with in handling the peculiar ores of the Mayari field had been overcome.

The ore is a decomposition product of serpentine rock, over which it lies as a highly-ferruginous mantle, averaging about 18 ft. in thickness. The uneven rolling surface of the underlying serpentine compelled the adoption of drag-line scrapers as the principal means of mining, though some steam shovels are also used. The ore is soft and much of it occurs in small shot-like particles. It contains an unusual amount of water, 12 per cent. of combined and 28 to 30 per cent. of hydroscopic moisture. When loose, the angle of repose is about 55 deg., but when shoveled or packed the ore has a clay-like consistency and the angle of repose is about 75 to 80 deg. Thus the physical conditions of the ore involved special problems in the way of mining, as well as of metallurgical treatment. The latter has been overcome by an installation of 12 nodulizing kilns. A number of interesting engineering features were described, among which was a series of gravity planes, 7000, 4000 and 2000 ft. long, respectively, by which the ore cars are delivered from the pits to the short railroad leading to the coast.

The lecture was one of exceptional interest in its description of the manner in which the engineering problems were solved, and was thoroughly enjoyed by those present. It is the intention to arrange for a series of similar meetings in order to promote a more active intercourse among the members of the institute.

Lucky Tiger Report

The annual report of the Lucky Tiger-Combination Gold Mining Company, which is operating a gold mine in the Moctezuma district of Sonora, Mexico, states that during 1910 there was mined and milled 38,915 tons of ore, which realized $915,036. The total tonnage of ore mined and milled since the commencement of operations to Dec. 31, 1910, amounted to 137,259 tons and the total amount realized $4,258,374. The profit for 1910 was $485,304, of which $429,000 was paid in dividends. To Dec. 31, 1910, a total of $910,000 had been paid in dividends.

The costs of operations for the year amounted to $343,710 and there was spent in addition $236,734 on the construction of the new mill and $59,616 for other purposes. The tonnage of ore in reserve now amounts to 218,280 tons; of which 67,780 tons is already broken in the stopes ready for milling. The ore developed during 1910 is $1.60 per ton higher in value than the general average of the ore reserves. The total ore broken during the year was 54,274 tons, of which 5275 tons were broken in development work and 3916 tons were broken under the Rynerson lease.

LUCKY-TIGER OPERATING COSTS FOR 1910

	Per ton
Mining	$2.468
Development	1.956
Tramming	0.220
Ore dressing	3.028
Ore freight	1.134
Ore expense	0.111
General	1.138
Total	$10.055
Sundry income	1.222
Net cost	$8.833

During the year there was milled 37,139 tons of dry ore that produced 2367 tons of concentrate, which was shipped to the smeltery at El Paso. There was also produced and shipped to the smeltery 1775 tons of sorted ore. The gross value of the ore milled, plus shipping ore, amounted to $1,427,196, or $36.57 per ton.

Exploration work on the main or Tiger vein in the Gold Hill section, in the southern portion of the property, has resulted in the discovery of a promising orebody, and several thousand tons of ore were extracted during the year, including several cars of shipping ore of good grade. This orebody is now being opened in depth on the 3½ level and continues in pay ore. Connection has been established between the seventh level and the upper portion of the mine, and this level is now used for transportation of all the ore from the mine to the mill. In the Sooy vein an orebody 250 ft. in length has been discovered on the seventh level. Work in the experimental plant has demonstrated that this ore can be successfully cyanided in the new mill.

Construction work on the new mill and power plant is nearing completion. The transmission line has been completed from the mine to Douglas, and the mill will probably be in operation by May 15. This will increase the milling capacity from 100 to 250 tons per day and make possible the retreatment of 81,000 tons of tailings now stored below the mill, with an estimated profit of between $5 and $6 per ton.

At the first of the year 1910, authorization was given for the construction of a 250-ton cyanide mill, various additions to the old mill and for the construction of an exhaust turbo-generator plant at the Copper Queen smeltery at Douglas, Ariz., together with a 66-mile transmission line to the Tiger mill.

Detection of Nickel in Presence of Cobalt

Neutral solutions of nickel and cobalt salts produce with potassium chromate solution precipitates of hydrated basic chromates, $2NiO, NiCrO_4$ and $CoO, CoCrO_4$, respectively. The nickel compound, chocolate brown in color, is formed slowly in the cold, even in concentrated solutions. To obtain a rapid precipitation it is necessary to heat to boiling. This reaction will show 0.000028 grams of nickel. The cobalt precipitate differs from the one just described in being reddish brown in color, in having a strong tendency to adhere to glass vessels, and in being formed rapidly in the cold in solutions containing more than two grams of cobalt per liter. From more dilute solutions the precipitation occurs on heating to boiling, and in this way 0.000032 gram of cobalt has been detected. Both compounds are formed only in neutral solutions; they are soluble in weak acids and in ammonia.

The recognition of nickel and cobalt in solutions containing both metals in about equal amounts is simple. (*Bull.* Soc. Chim. 1911, 9, 20-22). The solution is treated in the cold with a 10 per cent. solution of potassium chromate. The cobalt precipitate, formed in the cold, is filtered out and the filtrate heated to boiling to precipitate the nickel. If the solution of the metals contains little nickel relatively to the cobalt, the filtrate from the cobalt chromate is, as before, heated to boiling, when a precipitate appears containing nickel with a little cobalt. This precipitate is washed free from potassium chromate solution, dissolved in ammonia in the cold, and evaporated by heating in a small basin. If nickel is present the basic chromate separates after a time with its characteristic color, while the cobalt compound becomes dirty green. It is possible in this way to detect one part of nickel in presence of 100 parts of cobalt. If, in the solution of the metals, nickel preponderates greatly, e.g., in the proportion of 50:1, the cobalt chromate does not separate in the cold. In this case the liquid is heated to boiling, and the basic chromate precipitate then formed is filtered, washed, dissolved in ammonia and evaporated as described above. The formation of a dirty-green deposit shows the presence of cobalt.

Alaska Coal Lands

Speaking of conditions in Alaska, Isaac Guggenheim says: "The land situation up there is an outrage. The agricultural possibilities of the Copper River valley are enormous, but nothing can be done so long as nobody is permitted to touch the coal.

"Coal costs $12 or more a ton in Alaska, where it could be mined and distributed for $5 or $6. We do not own one foot of coal land in the Territory and have no desire to add anything to our investment there outside of our copper properties.

"With assistance of Morgan we have constructed a railroad from Cordova to our copper properties. We have put $20,000,000 into that railroad and would put in as much more as might be necessary to reach the coalfields if the Government would only adopt some stable policy for development of the fuel deposits it controls."

Chilean Nitrate Industry

The following figures on the Chilean nitrate industry are communicated by Minister Henry P. Fletcher, of Santiago, Chile, based upon the recently issued report of the Nitrate Propaganda Association. The production of the last few years is given as follows: 1908, 2,120,965 tons; 1909, 2,273,559 tons; 1910 (estimated), 2,667,000 tons; 1911 (estimated), 2,794,000 tons. Stocks held at northern Chilean ports on Dec. 31, 1910, were estimated at 503,747 tons.

The Nitrate Propaganda Association is extremely optimistic as to the general outlook, inasmuch as it declares that calcium cyanide has had only a meager success, and that calcium nitrate has not proved a successful fertilizer, while ammonium sulphate has been the only rival from a fertilizing standpoint, and that price considerations are against it.

Drilling in Michigan

On Sept. 1, 1910, there were 25 diamond drills in operation in the Lake Superior copper country, while at present there are only 14. These are worked as follows: two at the Senter-Dupee tract just north of Gratiot lake, two at the New Arcadian, one each at the Union Land (just west of the Allouez and North Kearsarge), Mayflower, Atlantic (underground), Algomah, Mass, Indiana, North Lake, Isle Royale (underground) and Contact (formerly Elm River).

The Lake Superior Copper Mines

By Dwight E. Woodbridge *

The first great copper district in the United States, opened in 1845; still in third place in annual production. The Keweenawan formation can be traced over 400 miles but the producing belt is only 70 miles long and from one to two miles wide.

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In a paper on the conservation of Michigan's exhaustible mineral resources, read before the Michigan Academy of Sciences, and to be published in the records of that body, R. C. Allen, State Geologist, has much to say of the copper mines of the State. A brief summary of his remarks, together with running comment on the same, follows: Mr. Allen sketches briefly the history of the industry and the geology of the copper-bearing rocks of Keweenaw peninsula. In substance he says that the copper industry of the United States may be said to date from the opening of the Michigan range in 1845, and that in the year 1847 the State produced 213 long tons of copper, out of a total of 300 tons made in the country. In 1850 Michigan produced 572 tons of the 650 made in North America, and up to 1887 was the leading producer, when it gave way to Montana and became second in rank. This place was held until 1905, at which time Arizona pushed both Montana and Michigan back one notch. But Michigan, on account of its early lead, is still ahead in the gross amount made, and has the added distinction of exhibiting the largest copper-mining operations, of attaining the lowest cost per ton of material handled, and of paying greater sums in dividends than any other copper area in the world. Keweenaw point," Mr. Allen says, "may be justly said to be the world's greatest mining district."

Limits of Copper Formation

Keweenaw point is a narrow peninsula projecting northeastward into Lake Superior a distance of 70 miles. The backbone of this peninsula is formed by the Keweenawan or copper-bearing rocks, which are a succession of dark basaltic lava flows, conveniently called traps, in lesser part of light-colored lavas, or quartz porphyries, and interbedded layers of sandstones and conglomerates. The trap beds vary in thickness to above 100 ft. Sandstone and conglomerate beds form the upper part of the series, becoming diminishingly abundant downward till they become unimportant, in the lower third of the series. The entire series is 25,000 to 30,000 ft. thick, dips northwest at angles varying from 25 to 70 deg., and forms a narrow band, four to six miles wide, known as the "copper range," and which extends into the lake at the northern extremity of the peninsula. The copper-producing belt is one to two miles wide and 70 miles long. Its rocks are overlain on the west, in apparent conformity, by sandstone and conglomerate. A great fault extending from a point near the extremity of the peninsula through its center and far into the mainland to the south, drops flat-lying Cambrian sandstone down against the upturned edges of the Keweenawan series which latter is doubtless repeated east of the fault.

It is well to note, in passing, that the Lake Superior copper-bearing formation is at least 400 miles in extreme length, as shown by surface outcropings, extending for 150 miles through Michigan, and that more or less mining has been attempted, not alone along the entire length of its course in Michigan, but at various points through Wisconsin and even into east central Minnesota, where it outcrops in the vicinity of Hinckley, and on the extreme southern edge of Carlton county. But while "barrel copper" has been found in these westerly workings, there never has been a discovery outside of the 70 or 80 miles on the formation running southwesterly from the tip of Keweenaw point in which the dissemination of fine copper was sufficient to permit successful mine operations. The formation apparently forms a syncline, and dips to the surface again on the north side of Lake Superior, both in Minnesota and further to the north and east, along the Canadian shores, and on Isle Royale.

This is the one copper-mining region the main mineral of which is native copper; it occurs in the sandstones, conglomerates and trap beds, the two latter furnishing all the ores now mined or that have ever been profitably extracted. It occurs partly in crystalline but mainly in massive condition, forming casts and fillings in the conglomerate, there replacing both pebbles and matrix, and in the traps filling the amygdules of the original gases. It is also found in veins in cross fissures and in slips or fault planes. In these latter are sometimes single masses of native copper weighing many tons.

Only Two Conglomerate Beds Worked

Mr. Allen says that the conglomerate beds are richer in copper than the traps, but this is true, in fact, only of one known conglomerate bed, that of the Calumet & Hecla. Other conglomerates have been disappointing in their copper contents. Speaking of this rich conglomerate he says that it has been worked since the middle of the last century, and that its deepest workings are at a depth of 5000 ft. The precise date of the discovery and operation of the Calumet conglomerate was in 1866, since which time it has been continuously operated. The productive part of this bed is 12 to 15 ft. thick, and less than three miles long. It is of a felsitic nature and in this respect differs from many other conglomerates of the series. While many of these beds carry copper in minute quantities, only two of them have ever been seriously mined, and the Allouez, which is the second of these, has been a practical failure, taking it in general.

Amygdaloid Beds Now Greatest Producers

Though the amygdaloid beds are of low grade, this fact is compensated for by their number, evenness of mineralization, great extent, and by their greater ease and cheapness of working. Amygdaloid lodes occur characteristically in the upper parts of the trap beds that contain numerous gas cavities, or amygdules, in many cases extending into the base of the bed immediately overlying. It is these amygdaloid beds that are destined, says Mr. Allen, to bear in future the greater part of the output of Michigan copper mines. Indeed, at the present time they produce not far from 70 per cent. of the total metal coming from the region.

It is pointed out that the question of reserves of mineral is complicated by the price of the metal, that which is waste at 12c. per lb., is commercial ore at, say, 25c., or even at 15 or 18c. And because of the varying nature of geological conditions governing the occurrence of ores in different rocks of varying ages and characteristics, it is impossible to make a creditable guess as to reserves. It is true that a recent estimate places the total copper reserves in sight on the Michigan range at four thousand million pounds, estimating rock that carries upward of 0.5 per cent. (10 lb. per ton) as ore, but in considering this estimate it is well to remember that the average rock now mined will run about twice this percentage, and that it is difficult, on a 13- to 15c. copper market, to make anything under 15 lb. per ton a profitable ore. It cannot be expected that refinements of mining and reduction will continue to such an extent in the life of the present generation that copper rock carrying but 10 lb. of recoverable metal to the ton shall be minable at the present price of copper, nor at any such

price as seems justified by the outlook for the near future. The acceleration of increase of demand for refined copper has paralleled that of iron, however, and of the total yield of the United States, amounting, to 1911, to about 7,025,000 gross tons, 4,297,000 tons have been the result of the last 11 years. This is no less than 59.4 per cent. of the whole. That there will be a steady future increase in the consumption cannot be doubted for a moment.

One-third of the Lake Copper Produced at a Loss

This being so, the question arises where is the copper of the future to come from? Lindgren estimated in 1909 that on the basis of 13c. copper it was doubtful if the reserves of Montana and Arizona would last more than 10 years or those of Michigan more than 15. I think it probable that today he would postpone the time of reckoning, however. It is important to note that under present conditions more than a third of the Michigan product is being made at a loss, and such a condition cannot long continue. While Michigan's reserves are greater than those of other districts, they are lower in grade and cannot be mined at present prices of metal. In the early days of the Calumet lode its ores were so rich that they made the average percentage of the State several times higher than at present. Today while this lode has fallen to about 1.5 per cent. copper the proportion of its production to the whole of the State is so considerable that the average for the Michigan range is brought to about 1 per cent., although many of the amygdaloid mines are working on rock that returns from 13 to 16 lb. per ton. There is therefore the utmost need for the conservation of these resources.

If a person seeks the best possible illustration of practical conservation let him travel the copper country of Mighigan and witness operations there: The stoping of copper ore at depths to a mile underground from which 20 lb. or less of copper is recovered per ton of rock, the tramming of this ore on electric railroads to shafts through which it is hoisted in great loads at express-train speed to surface, where it is loaded into hopper-bottom cars and sent to vast mills filled with costly machinery, where the copper is separated from the rock gangue containing it, refined and cast into shapes —and all being done at a cost that permits the sale of the final product at 12c. per lb., or a total of $2.40 for the original ton of rock! In reducing costs to this level Michigan operators have added many millions of tons to the minable reserves of the country, and have thus conserved its resources to that extent. Further economies will doubtless add, in time, many additional million to the reserves. As in the case of iron ores practical conservation is being effected by the operation of known economic laws. As in the case of iron ore, the copper mining industry is in the hands of a few large companies. The tendency is toward further consolidation, as witness an important combination now proposed and that seems sure to be successful, because it is in line with the trend of economic laws and is natural and proper. With the gradual decline in tenor of ores, increasing depth of mines, growing charges for exploration and development, operators are under constant pressure to reduce costs and effect economies. Consolidation is one of the means toward this end.

Transvaal Notes

JOHANNESBURG CORRESPONDENCE

In a recent letter I noted the discovery near Klerksdorp on the far southwest of the Rand of a reef in a bore which some geologists claim to be the main reef. A shaft is now being sunk to cut this reef and it is reported that the reef has been cut in another bore hole three miles to the south. Results are kept secret but they are apparently satisfactory as some leading financiers are interesting themselves.

The discovery on the Roberts-Victor diamond mine proved to be less important than was supposed, being only an extension of a fissure or dike connected with the pipe.

Owing to various causes and chiefly to the large amount of waste mined from the pipe the results from the Voorspoed mine have been disappointing for the quarter ended March, 1911; 39,800 loads yielded 59,690 carats of diamonds or 14.9 carats per 100 loads.

The production of diamonds in Damaraland by the Diamond Regie for the year amounted to £798,865. There is news of the discovery of a new diamond pipe near the Premier mine and a prospector has returned from the Kalahard desert beyond Kimberley and Vyberg with some valuable stones.

The Geduld, adjoining the Modderfontein Deep mine on the Rand, is still in an unsatisfactory position, owing to its small reduction plant, the extra expense of development and 1,850,000 gal. of water per day met with. There are, however, over 500,000 tons exposed of a value of about 9 dwt. over 38 in. As no provision has been made for hauling separately and dumping unpayable development rock, some 19 per cent. of the ore going to mill was of this description and the yield from 127,500 tons milled for the year was 23s. 6d., while costs were 21 shillings.

The ore reserves on the Village Reef are 1,943,593 tons exposed in the south reef and main reef leader with a value of 6.1 dwt. over about 50 in. Approximately 115,000 tons of sand were packed in old stopes to protect the shaft. The disappointing feature in this mine was the impoverishment in depth and reduction in size of the south reef. The developments on both the south reef and main reef leader in the Reef-Turf mines shaft at 4000 ft. have, however, been good and have raised the general grade of the ore reserves.

The reports of the two Germiston Deep mines working between 3000 and 5000 ft. show low grade. The Simmer Reef crushed for 1910, 480,000 tons, including 40,000 tons of dump rock with 165 stamps, and ore reserves were 1,255,000 tons of a value of 5.01 dwt. The main inclines below the vertical shafts are nearly 3000 ft. deep, and the lower levels are showing better grade; working costs were 16s. 7.3d. per ton.

The next mine, the Jupiter, has 1,074,000 tons of 5.8 dwt. ore exposed and the main reef in the lower level is stated to be running 5.6 dwt. over 80 in. for long distances which would seem to indicate that the reefs are again widening in depth.

April Dividends

The accompanying table shows the amount per share and total amount of the dividends paid during April, 1911, by a number of mining and industrial companies in the United States, Canada and Mexico.

United States Mining Companies	Situation	Per Share	Total
Am. Zinc Ld. & Sm., z. .	Kan.	$0.50	$40,060
Anaconda, c.	Mont.	0.50	3,000,000
Arizona Copper, pf.	Ariz.	0.047	5,769
Copper Range Con., c. .	Mich.	1.00	385,000
Bunker Hill & Sul., l. . .	Ida.	0.25	81,750
Bingham-New Haven, c	Utah	0.20	44,137
Daly-West, s.l.	Utah	0.30	54,000
Goldfield Con., g	Nev.	0.50	1,779,424
Homestake, g	S. D.	0.50	109,200
Hecla Mining Co., s.l. . .	Ida.	0.01	10,000
North Butte, c.	Mont.	0.30	123,000
New Idria, q.	Cal.	0.30	30,000
Old Dominion M. & S. . .	Ariz.	0.50	81,000
Success, l.s	Ida.	0.01	15,000
Tonopah Belmont, g. . .	Nev.	0.25	375,000
Tonopah of Nevada, g. .	Nev.	0.40	400,000
Wolverine, c.	Mich.	5.00	300,000

Coal, Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Ag. Chem.	U.S.	3.00	544,590
Cen. Coal & Ck. Co.,com.	U.S.	1.50	76,875
Cen. Coal & Ck. Co., pfd.	U. S.	1.25	23,437
General Chem., pf.	U. S.	1.50	150,000
Guggenheim Expl. Co. .	U. S.	2.50	519,832
Old Dominion, c.	Ariz.	0.25	73,311
Pittsburg Coal	Penn.	1.75	271,262
Republic I. & S., pf. . . .	Ala.	1.75	357,296
Sloss-Shef., pf.	Ala.	1.75	117,250
U. S. Sm., Ref. & Min. Co., com	U. S.-Mex.	0.50	175,505
U. S. Sm., Ref. & Min. Co., pf	U. S.-Mex.	0.87½	425,286
Va.-Car. Chem	U. S.	2.00	360,000

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Buffalo Mines, s.	Ont.	$0.05	$50,000
Crown Reserve, s.	Ont.	0.05	88,441
Dominion Coal, com. . .	U. S.	1.00	150,000
Esperanza, s.g	Mex.	0.36	166,188
La Rose Con., s.	Ont.	0.10	149,840
Mck.-Dar. Sav., s.	Ont.	0.15	337,153
Mines Co. of America (new)	Mex.	0.22½	202,500
Nipissing, s.	Ont.	0.37½	450,000
San Toy, g	Mex.		
Temiskaming, s.	Ont.	0.03	75,000

The Tampico Oilfield, Mexico

By Sydney H. Ball *

The wells are in gently dipping beds of limestone, intersected by flows of basalt, and will probably be large producers of low-gravity fuel and refining oil during the next ten years.

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With the approaching completion of the Panama canal the development of a large production of fuel oil in its general vicinity is of great commercial interest. The Tampico oilfield, along the border of the states of Tamaulipas and Veracruz, Mexico, is in consequence attracting attention. This oilfield is one of a number of oil districts situated along the Gulf of Mexico, including the Beaumont, Jennings, Caddo, Corsicana and Isthmus of Tehuantepec oilfields. Each is situated in either Cretaceous or Tertiary beds along the Gulf of Mexico, toward which the rocks are gently inclined.

Development started in the Tampico district, at Ebano, about 10 years ago, but general attention was only called to the district about four years ago by the picturesque oil war waged by the Waters-Pierce interests and S. Pearson & Sons (The Mexican Eagle Oil Company). The American interests are largely Californian and Texan with less Pennsylvanian. The known productive area of the Tampico field extends from Tampico west approximately 35 miles, and south from the city about 130 miles.

Oil Occurs in the Cretaceous

The Gulf of Mexico is bordered by a narrow marshy plain from which rises a dissected upland, culminating in Cerro Otontenec, a basalt mass about 2500 ft. above sea level. This mass trends north of northeast and so parallels the Sierra Madre range. To the north of Tancoco rather steep but broadly curved hills of Tertiary rocks, rising about 600 ft. above the deeper river valleys, are conspicuous. South of Tancoco the sedimentary hills are lower, serving to increase the prominence of cones and knife-edge ridges representing plugs and dikes of basalt which dot the country. The valleys of the main rivers even well up their courses, are broad and flat-bottomed. The marshy coastal plain has a heavy growth of rank grass, and elsewhere the country is covered with a dense growth of tropical trees, vines and shrubbery. The climate is semi-tropical; the health of Americans is fairly good, and Tampico itself could, by modern sanitary methods, be made a not unpleasant place to live in.

In addition to soil alluvium and old marine gravels pierced in places, the wells pass through Tertiary rocks into the Cretaceous series. The Tertiary rocks which cover the greater part of the district consist of at least 750 ft. of white vesicular limestone, thin white beds consisting of oyster shell, calcareous sandstone and yellow fine-grained sandstone containing much clay, felspar and mica. These rocks are separated from the underlying Cretaceous by a slight unconformity, but the structures of the two series are similar. Anticlines in the Tertiary rocks at the surface will be found also in the underlying Cretaceous rocks.

Soft bluish-gray massive shales of Cretaceous age, more rarely brown or red in color, outcrop at several points, and probably lie beneath the alluvium of many of the deeper valleys. Well records indicate that this shale is from 1700 to 2400 ft. thick. This rock is the capping which holds the oil in the formation next to be described. The wells pass from these shales to a blue shale with thin interbedded layers of limestone. The oil occurs in the cavernous limestone. This formation is reported to be 500 ft. thick. Below is 3000 ft. of porous dolomitic limestone; it contains a little oil and has been in part perhaps the source of the oil.

Igneous Rocks

The basalt and gabbro rocks intrude both the Cretaceous and the Tertiary formations and are perhaps of Pliocene age. They are particularly abundant in the western part of the region near Cerro Otontepec and in the region south thereof. They grade into one another and usually occur as dikes, plugs or batholiths; sometimes as sheets and flows. The sedimentary rocks near the larger masses are hardened and metamorphic rocks are developed from them.

The Tertiary rocks, although practically flat-lying, dip gently toward the coast. Superimposed on this easterly dip are various folds, the most prominent of which strike from northeast to southwest. Dips rarely exceed 5 deg., although near basalt intrusive masses the beds are in instances steeply inclined. Domes are formed by cross folds. Faulting accompanied the basaltic intrusions and to it the difference in level of the Cretaceous rocks in neighboring wells is to be ascribed.

With the exception of the Panuco and Topilo wells, which were drilled in the broad alluvial flat of the Panuco river, producing wells are located near asphalt seeps and ordinarily in the vicinity of intrusive masses of basalt. Strong asphalt seeps, which are frequently accompanied by a considerable escape of gas, are ordinarily situated near basalt or along a fracture; either a fault or a fractured zone near a basalt intrusion. The presence of asphalt indicates that at some former date at least the underlying rocks contained oil, while basalt intrusion points to the fact that the oil-bearing rocks have been sufficiently broken up to permit the rather free flow of oil. The basalt intrusions appear to have the effect which is artificially obtained in many wells by shooting.

Asphalt Seeps Near Faults

Asphalt seeps are widely distributed throughout the Tampico oil district, and occur either irregularly distributed over an area several acres in extent, or situated along well defined lines. In the latter case they presumably mark a fault and their presence is considered an especially good sign of oil in the underlying rocks. In the past some asphalt has been quarried from these seeps. As typical of these seeps (called by the Mexicans *ojos de chapapote* or "eyes of asphalt") one lying midway between Piedra Labrada and Cerro Azul may be described:

The country rock is Tertiary limestone, though basalt occurs both to the east and west within two miles. The largest seep, about 30 ft. in diameter, has soft black asphalt over an area 8 ft. in its center, and into this a pole 20 ft. long can be readily forced. Much gas, escaping with a hissing sound, forces holes through the soft asphalt. Most of the gas is a hydrocarbon, though hydrogen sulphide and sulphur dioxide are also evidently present.

An asphalt path connects this and a seep 100 ft. south 10 deg. west which is soft for 3 ft. across its center. The gas here forces the asphalt into iridescent bubbles. From this seep south 30 deg. west, a natural asphalt road from 30 to 60 ft. wide extends for 1500 ft., the asphalt escaping from that point down a small stream valley. At four or five places, for a distance of 850 ft. along this level stretch, the asphalt is soft and from it gas escapes. Across the basalt hill to the east are the Cerro Azul seepages, the largest by far in the district. They at least cover many acres and are reported to extend for several kilometers. Numerous active seeps occur at the heads of small valleys and the sub-valleys and main streams are filled with solid asphalt. From the more active seeps strong flows of gas escape. In smaller seeps elsewhere the gas upon being ignited burns with a long blue flame.

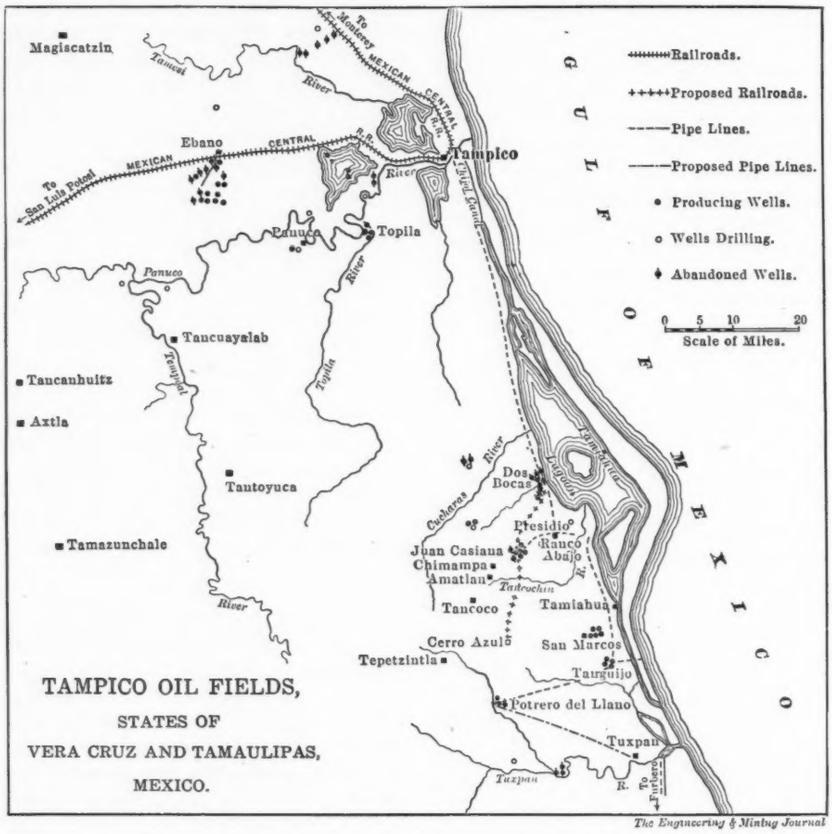
Production of the Wells

Accurate data concerning the wells drilled to date is difficult to obtain, but the following descriptions of wells is without question in the main accurate: The Huasteca Petroleum Company's wells at Juan Casiano, seven in number, are situated in a rather wide valley and in one of its tributary valleys. On either side steep Tertiary hills rise, perhaps 300 ft. The rocks in the vicinity, so far as seen, are horizontal. There are four producing wells reported to have flowed when brought in, respectively 35,000 12,000, 800 and 600 bbl. per day. From September, 1910 (when the pipe-line was completed) to the middle of March, 2,860,000 bbl. of oil, about 16,000 bbl. daily, had been delivered by pipe line at Tampico. Production is limited to the capacity of the pipe line. Three wells are variously reported to have gone crooked, or to be too shallow, but are perhaps dry. The wells are from 1700 to 1900 ft. deep. Strong asphalt seeps occur in the neighborhood, but the nearest known basalt is at Cerro de Oro, 2½ miles distant. The oil has an asphaltic base, is 20 deg. B. and in part is being refined at the Waters-Pierce refinery at Tampico, in part stored at Tampico, in part going to the Mexican National Gas Company, Mexico City and in part to Ebano, where it is mixed with the Ebano oil and delivered to the National Railways of Mexico. All of these wells have been brought in during the last two years.

The Ebano wells of the Mexican Petroleum Company, a sister corporation to the Huasteca Petroleum Company, both being Doheny & Canfield properties, are in level country, the earlier wells being situated near a conical butte said to be basalt. There are about 20 wells which at present market about 3700 bbl. of fuel oil (9 deg. Baumé) per day. The No. 3 Chijol well 6 miles south of Ebano, the largest, is reported to flow 800 bbl. per day of 14 deg. oil. The oil is more or less mixed with water and pumping is necessary in most wells, the product being afterward settled. These wells, which are said to be from 1650 to 1900 ft. deep are the oldest in the district and have been producing about nine years.

The Pearson and Dos Bocas Gushers

The new Peason (Mexican Eagle Company) gusher at Potrero del Llano, where drilling began about two years ago, lies in the Buena Vista river valley about 50 ft. from the stream. About one mile distant is a basalt hill, and nearby are asphalt seeps. This well, No. 4 came in about Dec. 27, 1910, and before it was successfully controlled, approximately 1,000,000 bbl. of oil escaped. The well is now under partial control, being capped but not shut in. The oil is being discharged into an earthen tank of 5,000,000 bbl. capacity, which was on March 25 two-thirds full. The foliage for 3 miles in every direction is blackened by the oil escaping prior to capping. Early in February it was gushing an 8-in. column of oil to a hight of 197 m. (640 feet), the daily flow then being probably 35,000 bbl.; while on March 16 it was estimated to be making from 75,000 to 80,000 bbl. per day. The oil is 22 deg. and has an asphalt-paraffin base. There are two other older wells nearby producing 600 and 800 bbl. (No. 1 and 2) respectively. The wells are reported to be 2000 ft. deep, and No. 4 is said to be 200 ft. into the oil-bearing limestones. At present in addition to the oil being stored a small quantity is pumped from the well to a tank on the



Tancochin river, where one of two or three steamers draw six barges (steel, 1500 lb.; wood, 1000 lb.) to the mouth of the Chijol canal. Single barges or two barges are drawn through the canal by gasolene launches. As a minimum 1800 bbl., and a maximum 7000 to 9000 bbl. per day is being marketed. Wells No. 3 and 5 stopped drilling when the big well was struck.

The Dos Bocas gusher of the Mexican Eagle Oil Company is situated near Tamiahua lagoon, near a possible fault along which seepages were abundant. This was a huge gusher which, at its zenith, is said to have spurted oil 1500 ft. high, and at one time to have flowed at least 90,000 bbl. per day. It began to gush on July 4, 1908, but soon caught fire. At the present time asphaltum and oil float on the lagoon for five miles from the well. The gusher (No. 3) is now a huge pond covering over 23 acres with its sides still continuing to fall in. The surface is covered with oil, while the center steams with hot sulphurous-calcareous water which at times is forced by gas into a huge balloon 30 ft. above the surface; it resembles some huge semi-extinct geyser. Well No. 1 which, prior to the fire, was a good producer, is capped and still gushes a little oil when uncapped, but it is essentially an abandoned well. A well drilled since the big gusher burned flows only hot sulphurous water.

The East Coast Oil Company (Southern Pacific) well at Topila had flowed about 50 bbl. per day and was being deepened when on about March 19, 1911 a steady flow was developed. It was capped, but through a small leak made about 200 bbl. per day. On March 25 it was opened and this intermittent gusher made from 5000 to 6000 bbl. per day. The same company 200 ft. away has a 50-bbl. well and near by an unsuccessful hole while the Waters-Pierce company across the creek has a small well of about the same capacity and one crooked hole. The oil is 20 deg. Baumé. The big well is a little over 2300 ft. deep, the other Southern Pacific well 2693 ft. deep (more or less oil from 2400 ft. down).

Little definite information exists as to the relative proportion of productive and dry wells, but it is probable that slightly less than 50 per cent. of the wells drilled have been productive. On the accom-

panying map the productive and non-productive wells known are shown, but a number of other dry wells have undoubtedly been drilled. The field should, from its great extent, not only be long lived, but also produce much oil.

Future of the Field

The field is too young to determine the average life of the wells. Some wells, like Dos Bocas, have been short lived, but in the 90 days of its life this gusher is estimated by some to have thrown out almost 9,000,000 bbl. of oil, equivalent to a life of 25 years at 1000 bbl. per day. The Ebano field alone has been producing for more than two years. About four years ago its product was 10,000 bbl. per day; at present from 2500 to 5000 bbl. per day. Taking 3700 as the present production this field appears, after reaching its maximum production, to have lost yearly about 25 per cent. This would indicate that in 10 years only the largest wells will be producers. Few fields have had so many large gushers, and as a result the average yield of the wells struck to date is high. A normal well appears to give from 500 to 1000 bbl. of oil per day.

The grade of oil is not high, and for the most part has a predominant asphaltic base. The oil, black in color and viscous, in a general way becomes better from north to south; that of the Ebano fields being low grade, while that of Potrero del Llano is much better, having a mixed asphalt and paraffin base. While the oil of this well, as well as that of a part of the Juan Casiano field, is being refined, the Tampico field is believed to be a fuel-oil producer.

The estimated oil production of Mexico in 1907 was 975,000 bbl. and 3,500,000 bbl. in 1910. In January, 1911, about 17,000 bbl. were being marketed daily, and in March, 1911, over 25,000 bbl. The 1911 product should be over 8,000,000 bbl. If all of the wells continued to produce at the present rate, and if all were marketed (neither of these conditions, however, is probable), the output this year should exceed the local demand for oil. The Mexican demand will, however, increase after the present unsettled political situation ends, but the future depends largely on creating a market in Europe for fuel oil, and in supplying not only the British Admiralty, but also the big steamship lines with fuel oil. Once a large annual production is assured, a fuel-oil market will create itself.

In March, 1911, three of the Tampico wells daily gushed a quantity of oil greater than the daily production of the 1500 Illinois oil wells, and Illinois is the third producing center in the United States. On Dec. 17, 1910, a contract for 2½ million barrels of crude oil at 92½c. per bbl. was made between the Ebano (Mexican Petroleum Company) and the Waters-Pierce company. Such favorable contracts will, however, not be made in the near future, 50c. per bbl. being considered a fair price.

Drillers get $7 per day and their American helpers, usually four in number, $4, in addition to board and lodging; they drill 11 hours. For ordinary labor the Mexicans, fairly efficient, receive 1.25 to 1.50 pesos per day. The labor supply is probably sufficient, but the wage is apt to rise.

Drilling and Shipping Facilities

As wells may go over 3000 ft., a heavy rig is necessary, a combined standard and rotary being preferable. The rotary is used for 1500 to 1800 ft. in the soft layers, and the standard rig to finish the hole. Drilling is or should be fairly rapid. Holes will take from three to six months, the Huasteca wells, 1800 to 1900 ft. deep, having been about four months drilling. Drilling is not particularly difficult if the wells do not encounter basalt. Wells in the latter rock go crooked and those in shale should be cased immediately, as the shale swells. The greatest danger appears to be from excessive gas pressure, which may blow out the casing and ruin the well. The drilling costs to date have been exceedingly high, and probably the majority of the wells have cost from $9 to $12 per foot. Careful management, however, should reduce this cost considerably and eventually companies doing a large amount of drilling should be able to drill wells to 2700 ft. at about $6 per ft. Wood for fuel is abundant.

Tampico is situated on the Panuco river, about six miles from the coast, and steamers of from 8000 to 10,000 tons and of 22-ft. draft, regularly call at the port. It is the natural supply point. Gasolene launches are used to reach most of the producing wells, which are situated fairly close to rivers which are navigable for launches drawing 2 ft. water. Well cut trails abound, but unfortunately no vehicles are used by the Mexicans, and as a result wagon roads must be built from the rivers to the places where drilling is being done.

At the present time there are no custom pipe lines in the district, but some will probably be built as the district develops. The principal pipe lines now existing within the district are as follows: The Huasteca Petroleum Company has an 8-in. pipe line 105½ km. long between its wells at Juan Casiano and Tampico (crossing the river at Tampico the line is sunk to river bottom). There are six pump stations of 200 h.p. each. Nine and a half kilometers from Juan Casiano a branch line, now abandoned, goes to Presidio. This pipe line, with pump stations, is said to have cost 14,300 pesos per kilometer. This same company has surveyed a railroad from Cerro Azul through Juan Casiano to San Geromino, near Dos Bocas.

The Mexican Eagle Oil Company has laid a 6-in. pipe line from its wells at Potrero del Llano to the Tancochin river and has projected a second pipe line (8-in.) from the former point to Tuxpan. The same company has a 6-in. pipe line from Tanguijo to the lagoon and Furber has a 6-in. pipe line (86 km. long) and a narrow-gage railroad from his field to a point on the coast east of Tuxpan. The East Coast Oil Company has a pipe line 8000 ft. long from its Panuco wells to the river of that name. It is rumored that the Huasteca Petroleum Company is soon to start a pipe line from the Juan Casiano wells to Mexico City, a concession having already been granted. Presumably the first stage of this pipe line will merely reach the Mexican Central Railroad.

At Tampico the Huasteca Petroleum Company has 30 steel tanks, each of 55,000 bbl. capacity, and in addition to other similar tanks, intends building a concrete reservoir at Tampico of 1,250,000 bbl. capacity, another at Geromino, where its pipe line reaches Tamiahua lagoon, of 750,000 bbl. and still another at Juan Casiano of 500,000 barrels.

Refineries

Some of the better oil is being refined, the refineries having the following daily capacities: Minatitlan (S. Pearson & Sons), 4000 to 6000 bbl.; Veracruz (Waters Pierce), 3000 bbl.; Tampico (Waters Pierce), 8000 bbl.; total, 15,000 to 17,000 bbl. The Minatitlan refinery is on the gulf, 350 miles from Tampico. It is being supplied by the Potrero del Llano, Furber and San Cristobal fields. The Waters-Pierce refineries treat Juan Casiano oil. At Ebano there is an asphalt plant, the product being largely used in Mexico, although a little is exported.

The majority of oil wells have been put down on land leased from the Mexican farmers. The leases are taken ordinarily for 30 years; a yearly rental, commonly paid two or three years in advance, and ordinarily from 5 to 10 per cent. of the oil being the consideration; 10 per cent. royalties prevail in the northern, while 5 per cent. is the ordinary royalty in the southern part of the field, except near the best asphalt seeps. The money consideration varies widely, according to the situation of the land, and is rapidly rising. In the early days many thousands of acres were leased as low as 50c. per acre.

Export shipments by water of California crude petroleum and products, including asphalt, for March aggregated in value $632,877. Crude destinations and quantities were: Panama, 102,000 bbl.; Salvador, 36; Chile, 42,000; Hawaii, 63,500; Alaska, 54,000; total value, $193,200, average price, 73.8c. per barrel.

California's Mining Building

Hearst Memorial mining building at the University of California affords excellent quarters for the mining college and is well equipped with modern mining and metallurgical machinery.

The Hearst Memorial mining building, occupied by the department of mining and metallurgy of the University of California, at Berkeley, Cal., is the gift of Mrs. Phoebe A. Hearst, as a memorial to her husband, the late United States Senator George Hearst. The architect of the building was Prof. John Galen Howard. In drawing the plans the architect worked in constant conference with Prof. S. B. Christy, the dean of the mining college. Between them, these two men visited nearly every college and technical school of rank in the Old World and in the New. While the design incorporated suggestions from many sources, it was in no sense a copy of any existing building in the world but was the result of a careful and comprehensive study of the needs of mining and metallurgical instruction on the Pacific coast. The building has in use proved admirably adapted to its purposes.

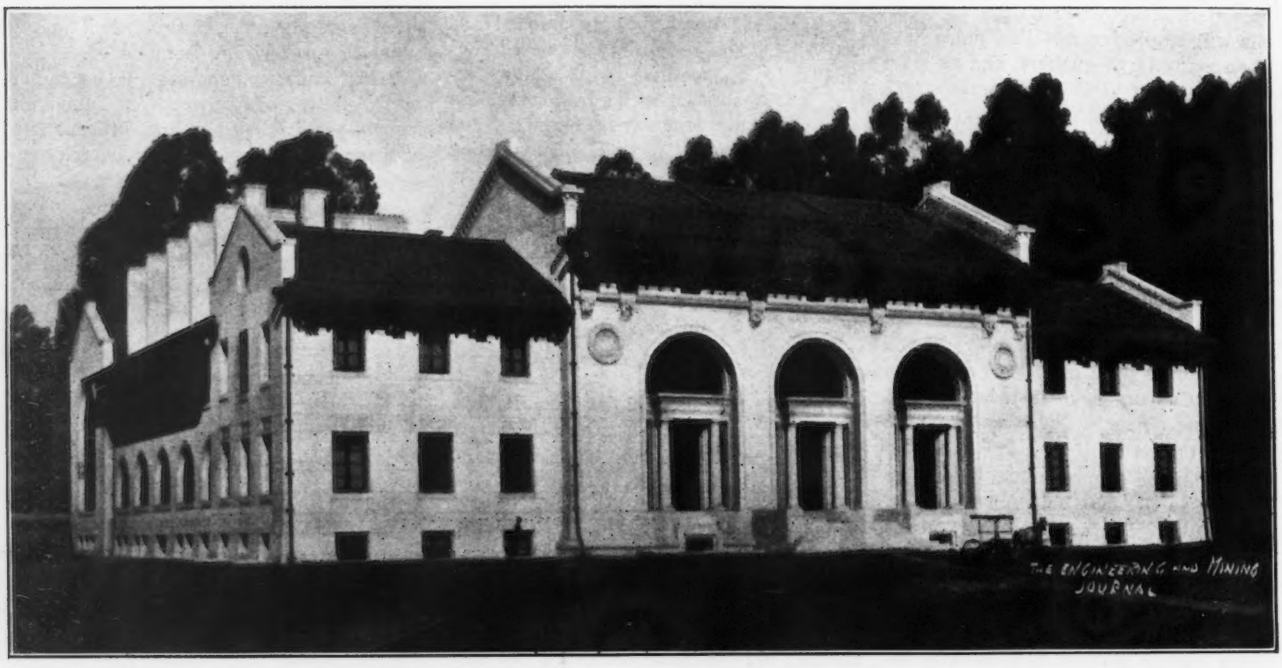
From east to west the building measures 181 ft.; from north to south 227 ft. It is of fireproof construction throughout. The walls are constructed of brick and faced with Raymond granite from the Sierra Nevada. The frame is steel; the floors are of reinforced concrete; and the roofs are of the same material covered with red tile. The building includes four working floors, each with an acre of floor space, and 16 ft. apart, giving practically 14 ft. of head room on each floor, and leaving space for the construction of mezzanine floors in the laboratories whenever needed.

Practical Mining Laboratory

There is a large and well lighted basement, entered from the west by a tunnel, through which heavy trucks may be driven directly to the storage and supply rooms. It contains steam-heating and ventilating appliances, and there is installed a 15-h.p. electrically driven air compressor and a 100-h.p., compound-duplex air compressor driven by a condensing steam engine, both of the Laidlaw-Dunn-Gordon make. Compressed air is now supplied continuously to all working parts of the building by the 15-h.p. compressor; the larger machine supplies power for the operation of air drills in the mining laboratory. These two air compressors serve to familiarize the students with standard appliances and methods of supplying compressed air for power in mining.

On this floor are two large store rooms carefully designed for the storage in a systematic manner of the supplies used in the building. Each store room is served by a separate electric elevator. Adjoining the store rooms are two sets of conveniently arranged locker rooms and laboratories with shower baths.

In the heart of the building on this floor is the mining laboratory. This room is 64 ft. high and about 50 ft. wide by 120 ft. long. It is surrounded by galleries on the second and third floors. It is lighted both from the sides and from above. It is provided also with an electric elevator, capable of carrying a load of five tons. Its entire length will be covered by a traveling electric crane with a capacity for handling five tons. To the right and left of this room, on the ground floor, are wings, arranged like the arms of a Roman cross. In the right wing are the forge rooms, provided with down-draft forges for the working of iron and steel, particularly equipped for miners' drill and tool sharpening. On the left are the metal and woodworking shops. The mining laboratory is supplied with about a hundred tons of blocks of granite, which are used to illustrate the operations of machine and hand rock drilling. From a central switchboard in this floor the electric service of the building is distributed. The working rooms of the building are provided with compressed air, water, steam, gas and electricity.



Hearst Memorial Mining Building, University of California

Assaying and Metallurgy

The entrance to the main floor is in the center of the south façade and opens into the memorial vestibule and museum of mining and metallurgy. This room measures 40x88 ft. and rises through

three stories to a hight of 50 ft. The walls and floor are of buff brick and the room is well lighted from the side and from above. Surrounding this room are balconies at the level of the third and fourth floors. Opening off the museum, on the first, second and third floors, there are three large lecture rooms and a number of offices and studies. A comfortable and well lighted reading room on the second floor is provided for the use of mining students of the upper classes.

The assaying laboratory opens off the right of the museum, forming the east wing of the building on the first floor, and contains six large rooms fitted with assay furnaces of different standard types, including soft-coal, coke and gasolene furnaces. In the left or west wing of the building is a similar suite of rooms, which will be devoted to experimental work in concentration, chlorination and amalgamation of gold and silver ores; to hyposulphite lixiviation and to cyanide work.

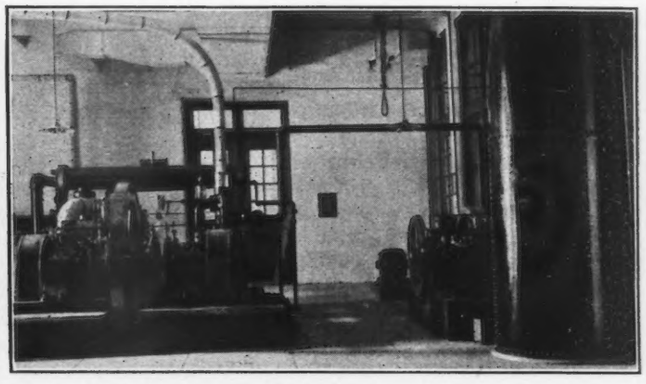
The rear of the building forms a tower 50 ft. square, extending up through three stories, devoted to the dry crushing and sampling of ores. These rooms contain several sets of rock crushers, a pair of Krom 16-in. swinging-pillow block steel rolls, a Sturtevant centrifugal mill, a coke-crushing and sizing plant, a Krom fine grinder and several sample grinders, together with bucket elevators, a Krom hexagonal trommel, and a set of shaking screens. The highest floor of this tower contains a number of ore bins and shelves for stock of ore samples, and a fine sampling floor. The three floors of the rock-crushing tower are connected by an elevator.

To the east of the dry crushing and sampling tower, and adjoining the assaying laboratory, is a large room, extending up through three stories, to be devoted to various types of roasting and smelting furnaces. To the left of the dry-crushing and sampling tower is another large room, extending up through three stories, devoted to ore dressing.

Connecting the front and rear ends of the building on the second floor are, on the right side, six large rooms directly over the assaying laboratories, which are devoted to advanced work in metallurgy by senior mining students. On the left is a similar suite of six large rooms devoted to research work. The third floor of the building contains a large room which will be fitted up as a steel stack and used as a reference library of mining and metallurgy; and two suites of five rooms each, lighted from above, will serve as drafting, designing, photographic and blueprinting rooms.

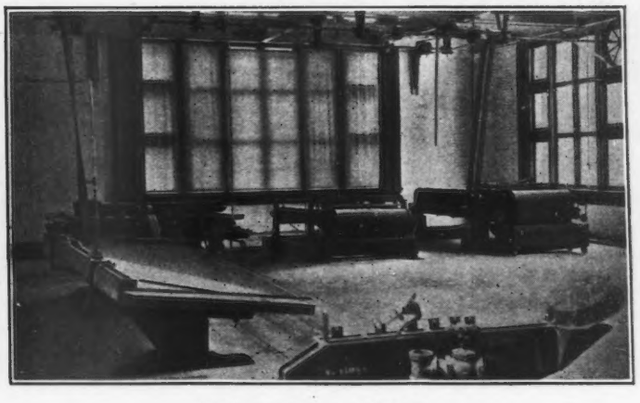
The building as it stands has cost over $600,000; the present equipment over $100,000; when the equipment is completed, the building and its equipment will represent an outlay of over a million dollars.

ASSAY LARORATORY



100-H.P. AIR COMPRESSOR

SAMPLING ROOM



CONCENTRATING ROOM

Oxyacetylene Welding

The welding of metals by fusion under a blowpipe flame of acetylene burning in a stream of pure oxygen is a commercial process, which, in recent years, has come to be widely used for welding thin pieces of metal and for repair work. By this method of fusion, known as autogenous welding, not only wrought iron and steel, but also cast iron, copper and other metals can be welded; in fact, in some cases, dissimilar metals have been welded by this process. The strength of oxyacetylene welded joints in thin steel plates is discussed in a bulletin issued by the University of Illinois, and the results of an extensive series of tests recorded. Information as to the convenience and efficiency of various methods of manipulating the oxyacetylene blowpipe flame is given, and it is shown that with careful manipulation a welded joint between thin steel plates may be expected to have a strength of about 85 per cent. of that of the solid steel plate.

A study of the proper proportioning of the gases and of the regulation of the flame was made and it was found that the proper regulation of the flame is not a matter of great difficulty. The limitations and adaptability of the process are discussed, and it is shown to be particularly adapted to the welding of thin plates and machine parts.

Further Data on Basic Converting

By Carr B. Neel*

Peirce-Smith converters improved by moving mouth to center and substituting pipe tuyeres; number of tuyeres increased to 37 with good results. Ordinary converters easily changed to basic lined, giving lower costs. Anaconda adopts this system.

*Metallurgical engineer, Salt Lake City, Utah.

Since the article on basic converting, which appeared in the JOURNAL of April 8, 1911, was written, one of the converters there referred to has had its mouth moved from the end to as near the center as the present design of the converter permitted. The converter has been in operation only a few weeks, but the results already attained have proved so favorable that it is now the intention to move the mouths in the other converters toward the center at the earliest opportunity.

Though this converter has five more tuyeres—37—than the others, less slag and matte are thrown from the mouth during the blow and also, when the converter is turned up just after charging the dried flux, less flue dust is blown out. The additional tuyeres also cause the converter to work faster. With the 32-tuyere converters, when 10 tons of copper were finished per hour in blowing from white metal to copper, it was considered good. Now, with the 37-tuyere converter, 14 to 15 tons of copper can be finished per hour. In order to avoid the loss of flue dust when charging flux, attempts have been made at another smeltery to introduce the fine material through the tuyeres with the blast. This has been done successfully and it was found that as much as six or seven tons of material per tuyere per hour could be handled this way. However, it was not found advisable to introduce all the flux in this manner nor has it yet been determined whether this method of feeding the flux possesses sufficient points of advantage to offset the disadvantages inherent in this system.

REMOVABLE PIPE TUYERES INTRODUCED

A further change that has lately been made in the large basic converters is the introduction of removable pipe tuyeres in the place of the fixed square tuyeres originally used. This invention will permit the removal of the tuyere when filled with copper or matte and its replacement by a new tuyere without having to drill out the old, as was formerly done. This removable tuyere was invented simultaneously at a rival plant and this is again a case where two inventions were worked out independently and the same result obtained by but slightly differing means.

In the second plant, acid converters have been changed to basic by the simple substitution of magnesia brick for the old acid lining. These converters are smaller than the Peirce-Smith type, being the regular 12½x8-ft. barrel converter with a capacity of from one-third to one-fourth of the 26x10-ft. Peirce-Smith. This change in lining has already given better results, as the matte is low grade, approximating 25 per cent. copper, and the men prefer the basic to the old acid converter.

At Anaconda, an improved mortar for magnesite lining has been discovered, by accident, it is said. Instead of the linseed oil-magnesite dust mortar used by Smith and Peirce, a mixture of 5 parts sodium silicate to 100 parts magnesite dust is used. This product sets slowly but forms a stable and coherent mass when hard. Being slow setting it apparently adjusts itself to its surroundings as it hardens and so automatically takes up the expansion of the brick and seems to give a better lining at the tuyeres than shaped magnesite brick. The practice at present is to tamp around the tuyeres a narrow belt of this magnesite mortar from 18 to 20 in. thick with magnesite brick above and below this belt. This belt has to be dried rather slowly, as in one case, where too short a time was allowed, from 12 to 14 in. scaled off the first time the converter was used. However, this did not seem to affect the rest of the lining and the converter seems as good after a 1½-month campaign as it was at the start, and the 6 or 8 in. remaining at the tuyeres appears to be no thinner.

ANALYSES OF MATERIALS

	Cu	SiO_2	Fe	S
Reverb. matte	42.36	2.32	26.7	26.3
B.-F. matte	37.4	2.0	33.4	24.4
Concentrates	28.49	27.1	13.0	20.0
Silica	3.39	68.5	9.3	0.7
Converter slag (clean)	1.73	27.5	47.4	0.9

BASIC CONVERTERS USED AT ANACONDA

The entire Anaconda plant has been changed from acid to basic converters and it is claimed there that their lining costs have been reduced to less than 30c. per ton of copper. The converters there are also 12½x8 ft., and one of these converters has produced over 2000 tons of copper with one lining on a 40 per cent. matte. Further, the number of basic converters required to produce the same amount of copper as was formerly produced by the acid is about 2:3. The smaller converter has required less punching heretofore than the Peirce-Smith. This may be due to the fact that the small converter can be skimmed more cleanly than the large one, and so when blowing less slag is mingled with the matte and carried below the matte line, to stick against the tuyeres when chilled by the incoming air.

Accompanying is a tabulated statement of converter operations for one month, Peirce-Smith converters being used. The figures given for the amount of air consumed per converter are based on metallurgical calculations as all the converters draw their air from the same blast pipe and the only figures relating to the air which are available are those giving the total amount of air furnished to all the converters. For the first 30,000 tons of copper produced the loss of magnesite material per ton of copper produced was 11 lb. while for the next 27,000 tons the loss dropped to 9.7 lb. This is being still further improved.

EXPLANATION OF TABLE

In the summary of converter operations by "number of blows" is meant the number of times the converter was turned up to blow after skimming, each blow ranging from 10 to 70 min. or even longer; the average being about 45 min. "Blowing on matte" includes the period of actual blowing from the start of the charge to the time that the converter is turned down for the last skim after the charge is high. "Blowing on copper" comprises the balance of the period of blowing and is the time consumed in transforming the white metal to copper. The period "between blows" is the time lost in skimming, charging flux and matte, delays, etc., and includes all the time from when the converter was turned down to the time it starts blowing again. By "between charges" is meant the time lost between the time of pouring out the copper and the time at which the converter starts blowing on a fresh charge. This time includes the time of charging from 40 to 50 tons of matte and various delays, such as cleaning the hood, waits on matte, etc. "Pouring copper" comprises the period from the time at which the converter was turned down at the finish to the time that the last ladle of copper leaves the converter, inclusive of all delays incident to the transfer.

SUMMARY OF BASIC CONVERTER OPERATIONS FOR THE MONTH OF NOVEMBER, 1910

	Tons					Tons Copper Produced			Time (Minutes)						Total Operating Time	
									Blowing On							
	Rev. Matte	B. F. Matte	Concentrates	Silica	Conv. Slag	Per Charge	Per Day	Per Month	No. Charges	No. Blows	Matte	Copper	Total	Between Blows	Between Charges	Pouring Copper	Days	Minutes
Conv. No. 1	1,827	1,594	234	826	2,269	.....	42.4	1,272	46	528	13,955	8,530	22,485	12,700	4,240	3,775	30 d.	43,200
Per ton copper	1.44	1.25	0.18	0.65	1.78	.....	.....	.....	...	0.41	11.0	6.7	17.7	9.9	3.3	3.0	.....	33.9
Per charge	39.7	34.6	5.1	18.0	49.3	27.7	.....	.....	...	11.5	304	185	489	276	92	82	.....	939
Conv. No. 2	1,405	910	214	527	1,501	.....	46.3	1,005	30	383	10,405	7,780	18,185	8,105	3,125	1,945	21 d.–18⅞ hr.	31,360
Per ton copper	1.40	0.90	0.21	0.52	1.49	.....	.....	.....	...	0.38	10.4	7.8	18.2	8.1	3.1	1.9	.....	31.3
Per charge	46.8	30.3	7.1	17.6	50.0	33.5	.....	.....	...	12.8	347	259	606	270	104	65	.....	1,045
Conv. No. 3	2,098	1,304	670	662	2,382	.....	47.3	1,419	41	548	14,610	9,250	23,860	12,200	3,490	3,650	30 d.	43,200
Per ton copper	1.48	0.92	0.47	0.47	1.68	.....	.....	.....	...	0.39	10.3	6.5	16.8	8.6	2.4	2.6	.....	30.4
Per charge	51.1	32.7	16.3	16.1	58.1	34.6	.....	.....	...	13.4	357	225	582	297	85	89	.....	1,053
Conv. No. 4	2,241	630	418	666	1,985	.....	47.9	1,238	35	460	12,550	8,275	20,825	10,155	3,100	3,180	25 d.—21 hr.	37,260
Per ton copper	1.81	0.51	0.34	0.54	1.60	.....	.....	.....	...	0.37	10.1	6.7	16.8	8.2	2.5	2.6	.....	30.1
Per charge	64.1	18.0	11.9	19.0	56.7	35.4	.....	.....	...	13.1	359	236	595	290	89	90	.....	1,064
Conv. No. 5	1,005	282	138	360	950	.....	38.7	503	16	239	6,560	3,950	10,510	5,230	1,655	1,310	12 d.–23½ hr.	18,765
Per ton copper	2.00	0.56	0.27	0.72	1.89	.....	.....	.....	...	0.46	13.0	7.9	20.9	10.3	3.3	2.6	.....	37.1
Per charge	62.8	17.6	8.6	22.5	59.4	31.4	.....	.....	...	14.4	410	247	657	327	103	82	.....	1,169
Totals	8,576	4,720	1,674	3,041	9,087	.....	45.0	5,437	168	2,140	58,080	37,785	95,865	48,290	15,610	13,860	120½–153 hr.	179,725
Average per ton copper	1.58	0.87	0.31	0.56	1.67	.....	.....	.....	...	0.40	10.7	6.9	17.6	8.9	2.9	2.6	.....	32.0
Average per charge	51.5	28.1	10.0	18.1	54.1	32.3	.....	.....	...	12.8	345	225	570	288	93	83	.....	1,034
Average per cent	....	....	....	....	....	....	....	....	...	....	33.4	21.8	55.2	27.8	9.0	8.0	.....	100.0

CUBIC FEET OF AIR FURNISHED AT POWER HOUSE TO THE CONVERTERS (Displacement Measurement)

	Conv. No. 1			Conv. No. 2			Conv. No. 3			Conv. No. 4			Conv. No. 5			Average		
	On Matte	On Cu	For Both	On Matte	On Cu	For Both	On Matte	On Cu	For Both	On Matte	On Cu	For Both	On Matte	On Cu	For Both	On Matte	On Cu	For Both
Per ton copper produced	113,000	44,000	157,000	91,600	44,100	135,700	106,500	44,100	150,600	97,500	44,000	141,500	109,000	44,200	153,200	103,500	44,100	147,600
Per minute	10,300	6,600	8,900	8,800	5,700	7,500	10,400	6,800	9,000	9,600	6,600	8,400	8,400	5,600	7,300	9,700	6,300	8,400
Lb. S oxidized per min	78	78	78	65	68	66	80	80	80	74	79	76	84	67	77	74	76	75
Lb. S + Fe expressed as S	124	.....	.....	106	.....	.....	124	.....	.....	115	.....	.....	100	.....	.....	116	.....	.....
Lb. Fe oxidized per min	159	.....	.....	143	.....	.....	154	.....	.....	146	.....	.....	124	.....	.....	148	.....	.....
Lb. Fe + S expressed as Fe	433	.....	.....	372	.....	.....	435	.....	.....	404	.....	.....	351	.....	.....	406	.....	.....

For the month of which the summary has been given, 107.5 horsepower-hours were required to produce 1 ton of copper against 109.8 horsepower-hours for July. This gain was partially due to the lower blast pressure used in November—9.17 lb. against 11.18 lb. The weight of air used, however, was greater in November than in July—4.94 tons against 4.86 tons—though the cubic feet of air used per ton of copper produced was 147,600 in November, while in July the amount used was 154,300. This apparent discrepancy is due to the higher temperature in July.

Honduras Rosario Report

The thirtieth annual report of the New York & Honduras Rosario Mining Company for the year ended Sept. 30, 1910, states that 36,634 tons of ore was milled which yielded $857,008 or $23.40 per ton. The operating cost was $13 per ton. In milling 86.17 per cent. of the silver and 89.68 per cent. of the gold was recovered, or an average of 87.73 per cent. of the metallic contents of the ore. Since 1882 the mines have produced $15,530,574 as bullion and 170 dividends of a total amount of $2,970,000 have been paid. The dividends paid during the last year amounted to $105,000, which amount is less than has been paid for any year since 1904.

The mines of the company are near the village of San Juancito, near the headwaters of the Choluteca river in the department of Tegucigalpa and about 20 miles northwest of the city of Tegucigalpa, the capital of Honduras.

The Crucero mines are now the largest producers that the company owns and have taken the place of the Candelaria vein system. During the last year 12,918 ft. of development work was done and the total ore reserve measured at the end of the year was 107,575 tons, of an average value of $25.30; waste to the amount of 24 per cent. is included in this tonnage.

A new mill is now being built and 20 stamps, each weighing 1800 lb., have been shipped. An interesting item of the report is the statement of the mine superintendent to the effect that air drills are now being used. Machine men were obtained from Cripple Creek and they have been extending the Crucero crosscut at the rate of 150 ft. per month. The men have had nothing but praise for the native miners and some of the promising young natives have done fairly efficient work with machine drills. In the Capitana and San Miguel veins the interval between levels has been increased to 200 ft. It is said that sufficient information of the blocks of ore is obtained and the development expense is proportionally reduced. The operating costs on a 200-ft. as compared with a 100-ft. lift are about the same.

Tonopah and Its Geology

By Claude T. Rice

Two main vein systems occur in Tertiary volcanics. Upper rhyolite, apparently extrusive, limits ore. Little is to be expected below earlier andesite except toward west and east where better circulation prevailed.

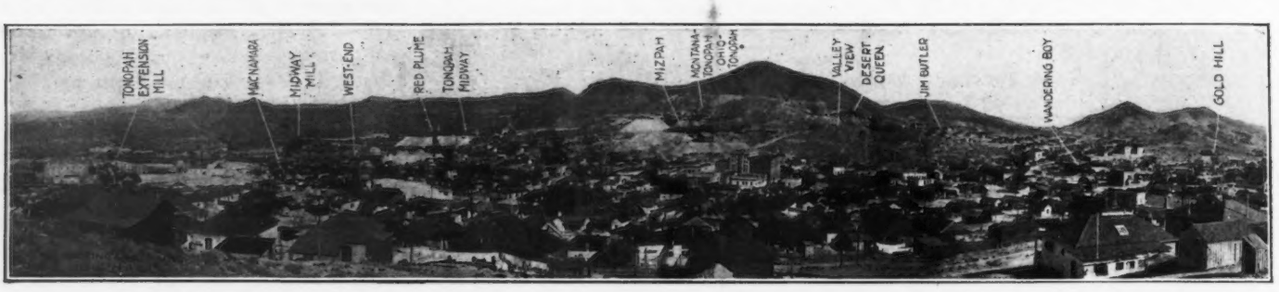
Ore was discovered at Tonopah, Nev., by Jim Butler, on May 17, 1900, and the first shipment was made near the end of October of that year. Unlike Goldfield, the camp was developed mainly by companies rather than by leasers. Ten years of mining has told on the camp. Already some of the veins are worked out, as far as they can be traced.

Veins Fail in Rhyolite

The veins of Tonopah strike a flow of rhyolite and begin to falter, then quickly pinch out. As far as present development has shown, much cannot be expected of the veins in the rhyolite, although in the Montana-Tonopah some stoping is being done in it, and the Tonopah Extension has ore for a depth of 100 ft. in rhyolite. But only at the Extension mine does the ore continue after both walls have become rhyolite, the reason for which I will try to explain later. In all other instances the ore dies out quickly after the vein is wholly in the underlying rhyolite.

It is evident that the ore-bearing solutions came from below, but from where is still the enigma of the camp. Drill holes sunk to a depth of 2000 ft. failed to pass out of the lower rhyolite and nowhere has ore been found to come up through the rhyolite.

Because of the many complexities, writers on Tonopah have generally avoided the subject of how the ore got there. It may, therefore, seem rash of me to try to deal with the problem, and many after reading this article will be reminded of the saying about fools and angels. I should be foolish indeed if I were basing my opinions on my own observations alone, for other than a few weeks spent in the camp in 1906 and four weeks during the last of 1910, my personal knowledge of the district is nil. I am merely going to correlate the observations of engineers who have worked in the district for several years. Where the observations of these men agreed, I have taken them as established facts. The disputed points I have avoided as much as possible, but the main one, as to whether the upper rhyolite (or rhyolite-dacite) between the earlier andesite and the calcite-andesite is a flow, as Prof. A. C. Lawson first suggested, or an intrusion, as considered by J. E. Spurr, had to be faced. So I have taken what seemed to be the more reasonable view and considered this rhyolite a flow. In general, where there was disagreement, I have considered that the man who worked the most in that part of the camp should know the conditions the best, other things being equal.



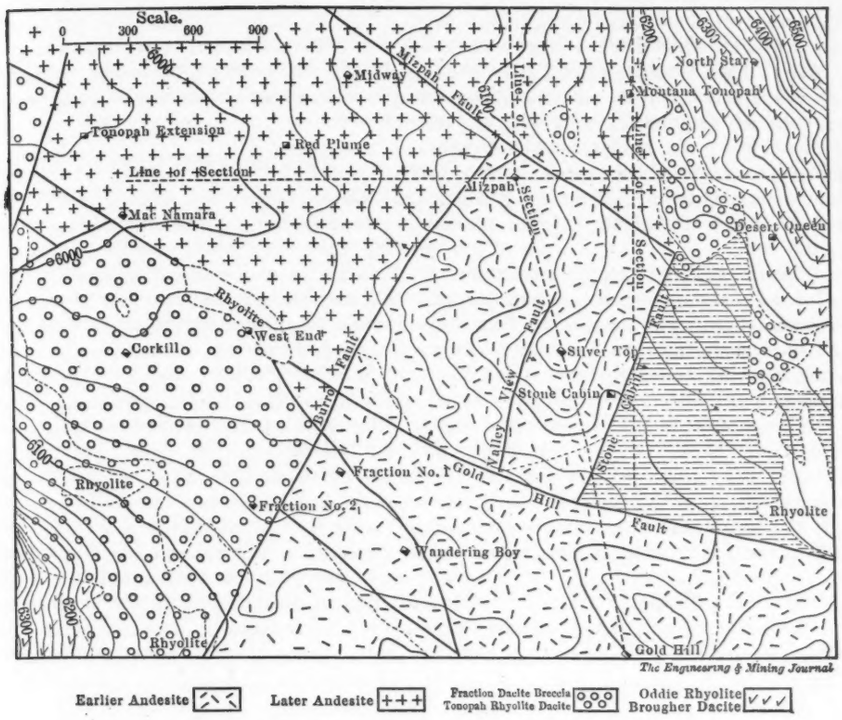
Panoramic View of Tonopah, Nevada

Rhyolite-Dacite—Flow or Intrusion?

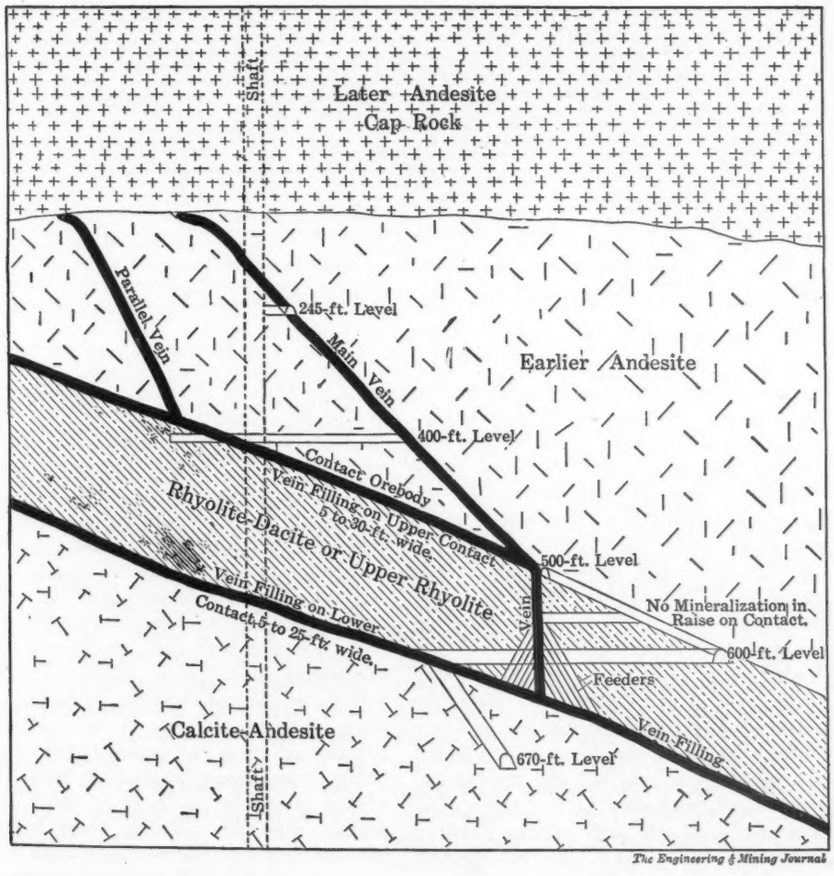
As to the rhyolite-dacite, most of the mining men in the district seem to accept the flow theory. Still, it is said that in the Montana-Tonopah mine, rhyolite and earlier andesite have been found frozen together, with other indications that the rhyolite is intrusive. In the Belmont mine there are several places where a rhyolite, thought to be rhyolite-dacite, has apparently been intruded into the earlier andesite. This would seem to prove the intrusive theory. On the other hand, I give accompanying this article a diagrammatic section showing the conditions that prevail in the Tonopah Extension mine in the vicinity of the main vein and in the western fault block about 500 ft. west of the shaft. This appears to show that in that part of the camp the rhyolite is prior to the mineralization and a flow under the earlier andesite.

I am inclined to question whether the rhyolite in the Belmont is the same as that under the andesite flow at the Tonopah Extension, for it should be remembered that the whole region is made up of a series of rhyolite and andesite volcanics and that these different rhyolites and andesites form two series of rocks quite similar in chemical and physical character in certain phases. The whole region is greatly broken up and complicated by faulting, while the rocks are all much altered by mineralizing agents and in many instances much decomposed. On this account it is difficult to determine in many instances whether an andesitic rock is calcite-andesite, earlier andesite or later andesite, and the same holds true, it is reasonable to suppose, with the rhyolitic rocks. On that account also, the petrographic determinations of the relationship of the rocks is open to doubt; basing the age of the rhyolite upon other than purely petrographic reasons begs the question, as it assumes a flow origin.

It is really a problem that applied petrology should solve, rather than field work, but as the microscope as yet has not unraveled the history of this rhyolite rock, I had to balance probabilities in coming to my conclusion. The fact that the rhyolite-dacite or upper rhyolite is of such general extent in the district under the earlier andesite, and has nowhere been found wanting; that it always is found between the two lower andesites, whenever both the earlier and the calcite-andesite are present, and never sending off dikes through the earlier andesite or "lode porphyry;" that the veins are generally found to extend some distance into the rhyolite, but as soon as both walls become rhyolite, the ore begins to diminish in grade, and with few exceptions dies out before the vein has extended more than 50 ft. into the rhyolite; the absence of apophyses, at least throughout a great area of the camp; the fact that ore is found characteristically along the upper surface or contact of the upper rhyolite with the earlier andesite, together with the mineralization also of the lower contact in the western part



GEOLOGIC SURFACE MAP OF THE PRODUCING AREA OF TONOPAH (AFTER J. A. BURGESS)



DIAGRAMMATIC SECTION THROUGH TONOPAH EXTENSION MINE, 500 FT. WEST OF SHAFT

of the camp; all seem to me to indicate that the upper rhyolite cannot be an offshoot from the rhyolite-dacite flow at surface, or for that matter be anything but a flow. That the parts of the veins extending into the rhyolite are simply due to a downward transportation of the ore from the veins above into later cracks formed in the rhyolite, as would be the necessary supposition if the rhyolite were an intrusion, does not appear reasonable; these later "gashes" agree perfectly with the vein in the andesite above too frequently to be mere coincidences.

Therefore, I have preferred to consider the rhyolite in question to be a flow and to question whether the rhyolite intrusions in the earlier andesite are the same in age as the rhyolite under the earlier andesite in the west part of the camp.

GENERAL GEOLOGY OF THE CAMP

Tonopah is a camp of Tertiary lava flows, probably laid down on a Cambrian basement, as is the case at Goldfield, for these sedimentaries outcrop about four miles to the north and pieces of such rock have been found occluded in the lavas of the camp. The accompanying map and sections showing the geological conditions at Tonopah will greatly aid the reader in getting a clearer conception of the district. For these I must thank J. A. Burgess, who has kindly brought them uptodate[1]. It is known that some of the members as generally mapped are composed of several different flows.

Above the calcite-andesite occurs the upper rhyolite, which was described by J. E. Spurr[2] in 1905, as an intrusion. At that time the amount of work that had been done in the mines was comparatively small so that Mr. Spurr did not have a good opportunity to judge of the matter. But he surely is to be commended for taking a chance and expressing opinions on the geology when the camp was young and at a time when such work was needed badly to aid in doing intelligent prospecting. That this upper rhyolite was intrusive was the most natural thing to expect when it was found that there was no ore in this rock. In time development at depth became forced upon some of the mines, and so about two years ago the upper rhyolite, or rhyolite-dacite, was cut through to see if the veins were below and the intrusion had merely cut them off. The result of this work changed matters. Still, it was generally supposed in the district that the rhyolite was an intrusion until J. A Burgess, then mining geologist and now assistant superintendent of the Tonopah Mining Company, published an article[3] assembling the later knowledge in regard to the district and giving clearly his reasons for

[1] *Econ. Geol.*, Dec., 1909.

[2] *Professional Paper* No. 42, U. S. Geol. Surv.

[3] *Loc. Cit.*

viewing the upper rhyolite as a flow instead of an intrusion, as Spurr had stated. Since then this theory has gained general acceptance in the camp.

Above the upper rhyolite is what is called throughout the camp the "earlier andesite," but this rock has been determined by Spurr since his last visit to the district to be a trachyte, and is now called by him Mizpah trachyte. This rock throughout the district has been much altered, but it somewhat resembles the calcite-andesite, the main difference being that there is a tendency for the earlier andesite to have somewhat larger phenocrysts. The main orebodies occur in this earlier andesite, so in the camp it is often called the lode porphyry.

The veins seem to have been formed soon after the andesite was extruded. Then there followed a period of erosion, which, however, could not have lasted long, as most of the veins under the capping show little oxidization, while practically all the silver in this ore occurs in the sulphides. Next followed an extrusion of another andesite, the "later andesite," the capping andesite, or the "mud" of the early miners in the camp, in which there is little, if any, mineralization with the exception of the orebodies formed along the Mizpah fault in the workings of the Tonopah Mining Company, and also in the Desert Queen workings of the Tonopah-Belmont company. But it is interesting to note that orebodies along the Mizpah fault have been found only in these two instances, for in the Montana-Tonopah mine where there has been some prospecting of the fault, only a meager amount of quartz has been found along the Mizpah fault, and this is not of commercial value. This may possibly indicate a secondary origin for these orebodies, as they are found in both cases near large bodies of rich ore.

After the later andesite, which is mainly differentiated from the earlier andesite by the presence of biotite and crystals of feldspar, there was a series of extrusions, rhyolitic in character, followed by a lake period, in which tuffs were deposited. After that, another period of rhyolitic flows ensued. It is thought that the peaks of the district were old volcanic necks, for the underground workings show three principal areas where the post-mineral faulting is more pronounced than in the central part of the mineralized zone.

These are the areas contiguous to Mount Oddie, Mount Brougher and Mount Butler. In the case of the minor-vein system that the Tonopah Midway, the Montana-Tonopah and the North Star companies were working, the dependence of this faulting upon propinquity to Mount Oddie is very noticeable. In the Midway there is considerable faulting, in the Montana-Tonopah more, while in the North Star there has been so much to prevent profitable mining.

Faulting Makes Mining Expensive

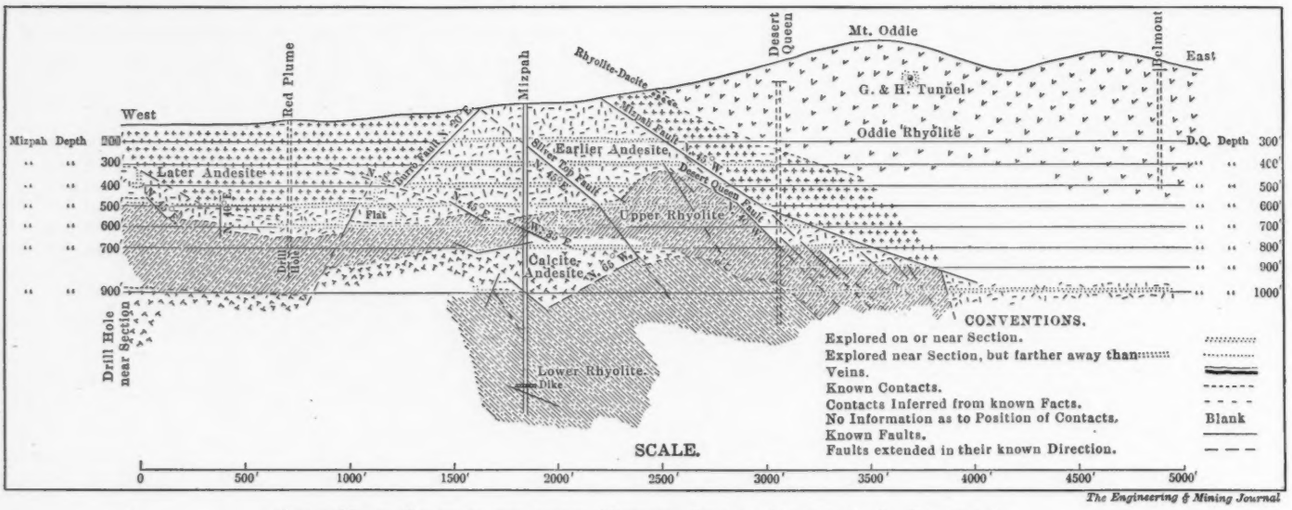
Owing to the propinquity of these three volcanic rocks, the whole ore-bearing area has been badly broken up by faults. This makes mining difficult and expensive, as much money must be spent in tracing the orebodies. The faults are of several periods. The earliest of any great importance are those along which the veins occur. These are prior to the outpouring of the later andesite. That there was a minor phase of this faulting preceding even the main-vein fissuring is indicated, as no continuation of the Valley View vein has as yet been found to the east of the Valley View fault; the Silver Top series of veins are a minor series that dip to the north in depth, but are vertical near surface and are not extensions of the Valley View system. The main strike of this prior-mineral faulting is east and west, and it was the direction of this faulting that determined the direction of the orebodies in the main-vein series of the district. After the veins had formed, yet prior to the outpouring of one of the later flows called the Brougher dacite, the veins were displaced by a series of faults that have roughly a northerly strike and an easterly dip.

Step Faulting

These faults are often step-like in character and are the important ones of the camp. Probably subsequently to this series and prior to the outpourings of the Brougher dacite was the minor series of faults in the three localities mentioned.

It may be added that there is a tendency for the flows to dip away from Mizpah hill, and in general the step faulting is away from the central outcropping area of earlier andesite on Mizpah hill as if there had been late in the life of the camp a slight uplift with that as a center. The vertical and lateral displacement upon most of the faults is not large, although along the Stone Cabin fault the throw is vertically about 600 ft., for along most of the faults a movement of more than a few feet is exceptional and seldom is more than 50 or 60 ft. This faulting is a detriment except in the case of the contact deposits, but in the contact mines it was the post-mineral faulting which permitted the entrance of the solutions that brought the primary mineralization up to commercial grade.

There was, it seems probable, one main period of ore formation in the district, and this was just previous to the outpouring of the later andesite. Later periods of mineral activity followed, but none of these appears to have formed commercial orebodies unless the two orebodies found along the Mizpah fault, one of the latest faults in the district, are primary orebodies. During the main period, the primary ore of the district was deposited in the main fractures and along the contact of the upper-rhyolite flow with the calcite-andesite below, as well



EAST-WEST SECTION THROUGH MIZPAH SHAFT (AFTER J. A. BURGESS).

as along the contact of the upper rhyolite with the earlier andesite above. It was during this period that occurred the wide-spread primary silification that carries the gold- and silver-bearing minerals.

Two Sources of Mineralization

This mineralization along the contact of the rhyolite is especially prominent in the western part of the camp, and as yet no such contact orebodies are known to the east of the Tonopah Midway mine. The fact that this mineralization of the contacts is confined to that part of the camp, at least as far as is known at present; the greater amount of the silica deposited in the veins of the western part of the camp; the characteristic presence of a black, jaspery quartz as a secondary filling in the veins and the absence of adularia (while in the veins of the Mizpah or eastern series of the camp adularia is often abundant and is characteristic, and the absence of black, jaspery quartz is equally marked) all indicate to me that there were two sources to the mineralization—one in the eastern and the other in the western part of the camp, although probably different vents from the same general magma.

These two different solutions were doing their work at about the same time, and other than in their relative amounts of silica and the presence of potassium in abundance in the eastern solution and the absence of such salts in the Western waters, it would appear from the character of the mineralization that the solutions were largely similar. There were, as has been suggested, other minor periods of metal-depositing activity. One of these caused the deposition of some stringers of ore on Mizpah hill that have mainly gold in them, but this is a local occurrence.

Tonopah Extension Fault Block

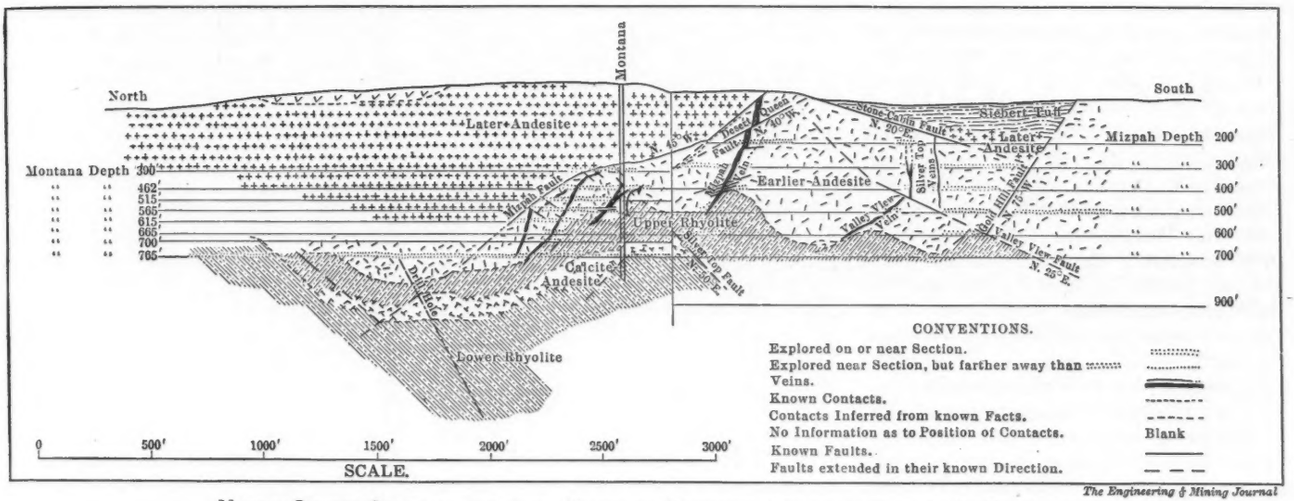
The manner of ore formation in the western part of the camp seems to be shown quite clearly by the diagrammatic section already referred to, of the vein conditions in the western fault block of the Tonopah Extension's main vein at a point about 500 ft. west of the main shaft. As it will be noted, both the upper and the lower contact of the upper rhyolite are mineralized, but the upper contact is not mineralized below the point where the vein that crosses it comes up from the lower contact.

It seems conclusively shown in this block that the solutions came up from the north and west along the lower contact for some distance at least until they met the fissure in the rhyolite. This break as it afforded a freer channel for the solutions, tapped the main flow and took most of the solution up through the rhyolite. Near the bottom of the rhyolite numerous feeders extend off in a fan shape to the contact. The width of this fan of feeders is about 50 ft. at the contact. Above the contact the feeders merge into the main vein, indicating conclusively in the manner that they do this that the solutions came up along the lower contact of the rhyolite into the vein.

Part of the solutions continued along the lower contact beyond the fissure vein that put off into the rhyolite, but at the upper contact there is an entirely different condition. On the lower part of upper contact below where the fissure coming up from the rhyolite cuts it, there is no silification of the contact other than a small seam of quartz three or four inches wide, that is accomplished by considerable calcite, showing the later character of this minor mineralization. Along the contact above where the fissure crosses, the silification is intense and a thick deposit of typical vein quartz is found up to and beyond the second vein in the andesite, which development has shown to spring from the upper contact as its feeder. The ore in the rhyolite fissure is as rich as any in the mine, but the vein in the andesite is stronger and larger. How the condition of affairs shown by this section could exist if the rhyolite is an intrusion later than the mineralization, I am unable to see.

In general along the contacts in the western part of the camp the quartz at present assays low, although seldom less than $2 per ton. The orebodies which the West End and the MacNamara are working are along the upper contact between the rhyolite-dacite and the earlier andesite. The mineralization occurs entirely in the rhyolite where a replacement has occurred as wide as 30 ft. or more in places and seldom as narrow as 5 ft. The ore is found along this contact wherever there has been a fracturing or faulting.

That secondary solutions did in places leach the original ore filling of the vein is shown in the Tonopah Extension workings in the sheeted zones near the main faults where the vein quartz has been broken up considerably by the drag of the fracturing. These zones are in general low grade and only the centers of the larger blocks of quartz show good ore. Outside the unleached kernel is the dull, dead quartz, inclined toward a reddish tinge, left after the gold and silver minerals had been leached out by the solutions that followed along these zones of later faulting.



North-South Section through Montana-Tonopah Shaft (after J. A. Burgess)

Disappearance of Calcite-Andesite

Before leaving the western part of the area it may be well to state that there are strong indications that the calcite-andesite is much thicker in that part than in the eastern part of the district, possibly on account of erosion, but probably due to the fact that it originally was thicker. Toward the east the calcite-andesite becomes thinner until it has disappeared in the Belmont workings. This disappearance of the calcite-andesite may possibly be one reason that the contact orebodies are absent in that part of the camp, for the solutions once they got into the earlier andesite would have been

inclined to follow the more open fissure zone rather than the tighter contacts.

East of the Belmont fault in the eastern part of the camp, the country as you go farther in that direction appears to become much less broken up by post-mineral faulting, although the prior-mineral breaks appear to be more numerous than in the western part of the camp. In the new orebody of the Belmont, the probable extension of the Mizpah vein beyond the Belmont fault (where it was long considered that ore would not be found until S. H. Brady and his engineer R. J. King, about a year and a half ago had enough courage to cast the traditions of the camp aside and go out and look for it) there are very few faults. This Belmont fault is quite in line with the Stone Cabin fault, and may be a continuation of that fault, but the Mizpah fault seems to peter out before reaching the Belmont. Probably these two faultings, the Belmont and the Mizpah, are closely related.

Two Main Vein Systems

As I have already said it seems to me that the veins at Tonopah belong to two main series, the eastern and the western. Among the veins that I would class as belonging to the eastern series are the Mizpah vein with its probable faulted extension, the Belmont vein, as the company calls the new extension that was found beyond the Belmont fault, the Valley View system, the Silver Top veins, the Wandering Boy and Fraction veins of the Jim Butler, the Montana and the Brougher-MacDonald veins in the Montana-Tonopah and the Midway workings. Probably also the Martha and the Triangle veins, found in the Montana-Tonopah workings, also belong to this system, although it is possible that these two south dipping veins of the Montana belong to the western vein system.

To the western veins I should judge belong the Extension main vein with its portion that projects into the ground of the Tonopah Mining Company and there called the Red Plume vein, the upper contact along the upper rhyolite which is opened up in the MacNamara, West End, Tonopah Extension and Tonopah Midway properties, and also the lower contact deposit between the upper rhyolite and the calcite-andesite which has been shown to carry ore in the MacNamara and which is strongly silicified, but low in grade in the few places where it has been cut in the Tonopah Extension property.

The veins of the camp all have a general easterly and westerly strike, and with the few exceptions of the Martha and Triangle veins worked in the Montanah-Tonopah mine, and the Wandering Boy and Fraction veins with their allied stringers that are found in the Jim Butler property the dip of the veins is toward the north. The angle of dip is generally about 45 deg. but this depends upon the vein and to a considerable extent upon the way that the post-mineral faulting has effected the vein.

The Important Minerals

The ore minerals throughout the camp are argentite, stephanite, polybasite, pyrargyrite, cérargyrite, and to a minor extent a selenide compound of silver. Some rhodonite, pyrite and chalcopyrite is found accompanying the ore. The ruby silver and the argentite are mainly secondary, if not entirely secondary minerals, while the primary silver minerals are the antimonial sulphides, stephanite and polybasite, as is the case on the Comstock. In one of the stopes on the Mizpah vein beautiful pale yellow crystals of silver iodide are found.

The manner of the occurrence of the gold is not known positively, but it is supposed to occur mainly in the silver minerals as in the concentrates that are made in treating the ores prior to cyaniding them, the ratio of silver to gold (about 100:1 by weight) that characterizes the vein holds fairly constant. In some of the veins, though, it is known that part of the gold occurs in the small amount of pyrite and chalcopyrite found in the ore. Plates of native silver have been found in the Tonopah-Belmont mine and some have been quite large.

Sterility of the Rhyolite

I have intentionally left until the last any attempt to explain the fact that the orebodies in general die out soon after the fissure enters the rhyolite. In many places the fissuring can unquestionably be traced below where the ore stops. This has seemed to many to show that, as the mineralization does not extend into the rhyolite as far as the fissuring does, the veins must have been formed by a downward transportation of the ore from the part of the vein lying in the andesite above, and that the rhyolite must be a post-mineral intrusion, as Spurr called it, which has been reöpened by subsequent movement along the main vein. But I think that another explanation fits the conditions far better.

Up to the present, the Tonopah Extension company has come the nearest to tracing the mineralizing solutions to depth, and it is only in this mine that the refilling in the vein continues to be strong and persistent in the rhyolite. This shows, as does also the fact that elsewhere for short distances the orebodies continue after the vein is entirely in the rhyolite, that the solutions can replace the rhyolite. In fact, such replacement has occurred quite extensively along the upper contact in the contact mines. Consequently, the reason that the solutions have not deposited more ore in the rhyolite to any great extent other than in the western part of the camp is, in my opinion, because the development work in the other parts of the camp has not been near the feeders that brought the mineralizing solutions up from below. Other than in the western part of the district, the work up to the present seems, with the exception of the new work in the Belmont, to be far from the feeders and so in part of the camp where the flow of the mineralizing solutions was lateral instead of upward.

Lack of Circulation in Rhyolite

There is no question that some of the fissures in this part of the camp did extend into the rhyolite, while others began and ended in the andesite, as is the case with the minor parallel vein shown in the section of the Tonopah Extension workings. But the fissures that did extend into the rhyolite were, in my opinion, filled with dead water in the parts that were in the rhyolite, while the parts of them in the andesite were above the permanent water level of that period. So only in the upper portions of fissures in the rhyolite did the mineralizing solutions, flowing along over the top of the dead water filling in the rhyolite, mingle with the waters in the vein. That, I believe, is the reason the veins in the central part of the camp pinch out so quickly when they reach the rhyolite.

It was the mineralizing solutions that did the main silification, and the veins only appear important where these silicifying solutions have eaten away the breccia filling that characterized these fissures caused by a sort of sheet fracturing. In other places they become sheetings and are easily lost as is the case with the Silver Top series. Therefore, it can be expected that no ore will be found to go down into the rhyolite until the part of the camp is reached where the mineral solutions were working upward and not flowing sideways. That appears to be to the east and to the west of the present workings, with the possibility, but not probability, that the West End south-dipping contact connects to the south with one of these deep feeders. In those parts of the camp, which as yet are unexplored, veins in the rhyolite may carry good ore at depths below the andesite.

The finding of the new ore in the Tonopah Belmont property has put new life in the district so that at Tonopah more new work is being done or is about to be done than has been the case since the boom days. Tonopah has a good future ahead of it because it seems that the mineralized zone must extend farther to the east and west than it has as yet been traced for the deeper feeders must come up somewhere, and it is in these directions that the future possibilities, the speculative values, pure and simple, lie. So Tonopah looks more promising than ever in the younger and outskirting properties. At present the camp has a gross output of about $750,000 per month. In conclusion I must thank the officials of the various operating companies for many kindnesses shown me while at Tonopah.

Coal Mining Department

The Important News Of Coal Mining: New Appliances, New Methods, New Fields, Colliery Engineering

The Danger of Mine Fires

WASHINGTON CORRESPONDENCE

Doctor Holmes, the chief of the Bureau of Mines, who has recently been investigating the conditions which led to coal-mine accidents of unusual severity in various parts of the country, has made the following statement to your correspondent, as the result of his observations:

Mine fires constitute an increasingly important cause of the loss of life, and also of the loss of property, in the coal mines of today. Mine fires which could easily have been prevented, and which after having been started, could easily have been extinguished if attended to promptly, cost the loss of 73 lives in the Pancoast colliery at Throop, recently, and 262 lives in the mine disaster at Cherry, Ill., in November, 1909. About the shafts, and about both the stables and the engine rooms, when these must be had underground, all constructions should be fireproof in character; and wherever in the mine combustible materials must be installed, an ample water supply and other fire-fighting appliances should be provided.

While no explosives are absolutely safe, only those explosives should be used in coal mines which are least likely to ignite either the gas or the dust. As rapidly as practicable, a system of electric firing of all the shots, at a time when all of the miners are out of the mine, should be generally adopted. Only the small quantities of any explosive needed for use during a single day should be in the mine at one time. Under no conditions should the powder and the detonators or caps be carried into the mine together. Nor should the powder or detonators be kept in any mine over night, as the dampness may change their quality.

A thorough wetting of the coal dust in any part of a bituminous-coal mine lessens the chances of a dust explosion; but the safest plan is to wet the coal dust throughout the entire mine; and this can be done in the cheapest and most satisfactory manner by turning the exhaust steam from the mine power plant into the mine along with the air current. Each precaution taken with a view to the prevention of mine accidents thereby lessens the probabilities of a disaster; but no miner or operator should feel satisfied until every precaution known to the industry has been taken.

The death of Joseph Evans, while wearing a helmet in examining the mine disaster at Throop, illustrates the dangerous character of this work; but the loss of 40 lives a few years ago in the rescue work at Hanna, Wyo., before the helmets came into use, indicates the far greater danger accompanying rescue work without the use of the helmets. At the recent Banner mine disaster in Alabama, the helmet men, in a vain search for miners yet alive, explored all parts of the mine, though it was filled with poisonous gases. These helmet men rescued from certain death six of their associates who, while not wearing helmets, had ventured too far into the mine, and were prostrated by the poisonous whitedamp without a moment's warning and in a moment's time.

The chief work of the Government rescue cars is the training of miners as to how to prevent mine disasters and how to take part in the rescue work as soon as a disaster happens. In a few years' time there will be miners trained in rescue work at every important colliery in the United States. These, when supplied with equipment, will rush to the rescue as soon as a disaster occurs.

First Aid Team Contest

INDIANAPOLIS CORRESPONDENCE

James Epperson, State inspector of mines for Indiana, has arranged for a contest to be held at Linton, Ind., on May 13, between the Terre Haute team from the Vandalia Coal Company and the Linton Vandalia team in the first-aid mine-rescue work. Dr. J. A. Holmes, director of the Bureau of Mines, of Washington, D. C., and Prof. H. H. Stoek, head of the department of mining of the University of Illinois, have been invited to act as judges of the contest.

A mine will be "erected" on the surface and conditions similar to those at the bottom of a shaft will be presented. Both teams will be divided into squads and will compete in the work of administering first aid to the make-believe patients. Part of the work will consist of inducing artificial respiration, carrying the wounded over falls and banks, bandaging lacerated flesh, splinting broken shoulder bones, broken arms and legs. Temporary hospitals will be arranged and only equipment usually to be had at the mines in emergency cases will be used.

It is the intention of Inspector Epperson to make the event one of the most notable ever held, and the program includes all-day exercises. It is to conclude with a banquet at night, after which the decision of the judges will be announced. The contest is the only one of its kind ever staged in the Central West, and the program has aroused unusual interest in mining circles.

Reweighing Coal Shipments

WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has issued an important order relating to the reweighing of shipments of coal in which it holds that a rule in the tariff of any railroad providing that shipments of coal should not be weighed except at point of origin is unreasonable. The road involved in this proceeding is the Oregon Short Line, and the substance of the order is: "That defendant, Oregon Short Line Railroad Company, be required to cease on or before June 1, 1911, and for a period of two years thereafter to abstain, from enforcing that portion of item 8 of its tariff dealing with the weighing of coal which reads: 'Shipments covered by such weighbills must not be reweighed.'"

In discussing the general situation under this rule the Commission says: "The defense offered is that under this provision there was no authority to reweigh the coal at destination, and that under the terms of said provision complainant is absolutely bound by the weights given at the point of origin and as stated in the waybills. The actual weight of shipments constitutes the true basis upon which to assess transportation charges. The question is one of fact, to be determined in a manner just to both parties, and as to which the *ex parte* action of either party cannot conclude the other. The provision in the tariffs that 'shipments covered by such waybills must not be reweighed,' is in our opinion a manifestly unjust and unreasonable requirement and constitutes no valid defense in a case where the question at issue is the correct weight upon which transportation charges are to be assessed. Upon the record, we are of opinion and find that the charges assessed and collected were unreasonable to the extent that they exceeded charges that would have accrued if assessed upon the actual tonnage of the shipment as shown by the evidence."

Block Signal System for Mines

By Mosco Haley*

Details of a switch and signal-lamp arrangement whereby six locomotives on each side of a mine can be safely handled by one man and all trains kept moving.

*Kentucky Midland Coal Company, Midland, Ky.

The following description and illustrations show an excellent block-signal system for underground tracks around shaft bottoms, junction of entries and other points where there might be confusion in haulage.

Plate No. 1 illustrates the controller or switch, and shows the general appearance of same and all the leads 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, or light wire conductors leading in the different directions to their respective signal lamps. The operating hand wheels *A* and *B* (Figs. 1 and 2) can be plainly seen, and close inspection shows that the bottom wheel *B* moves the upper drum *X*, and the other wheel *A* the *Y* drum by means of a staff running through the center of the drum *X* (Fig. 1). The posts 1 and 2 (Fig. 1) are merely fiber tubes around the stay bolts 11 and 12 (Fig. 1), by which all the contact springs and terminals are supported and held in position. It is plainly evident that the contact shoes are rigidly held in place by the use of springs.

The controller (Fig. 2 of Plate 1) is shown with the cover in place and the leads coming from the bottom. The positive wire $+C$ is to the left and the negative wire $-D$ to the right. The hand wheels shown in Fig. 4, Plate 1, give ample room for handling. It is shown that the lower drum (Fig. 3) has not the same number of connections as the upper one (Fig. 4), therefore, the contacts are farther apart on the perimeter of same.

By referring to the plan of the signal system used at the shaft bottom (Plate No. 3), it is seen that there are six rail switches and red lights on the south side of the shaft; on the north side, there are three rail switches and four red lights which require the construction of connections as above described.

Method of Operation

It is also plain that *S* light on the north block has no latch as the operator is close at hand and can see down No. 2 track toward the north and prevent all incoming loaded trains colliding with any empty trains going south, when coming out of the crossover *A*, and going up No. 1 track south and out through the crossover *B* on to No. 2 track. The distance can be spaced off equally between the number of red lights on the division, that is, the south contacts are six in number which are 60 deg. apart and the north contacts on drum *Y*, Plate 1, Fig. 1, are 90 deg. apart.

The diagram of wiring on Plate No. 2 shows that the contact plate *A*, Fig. 2, also Fig. 1, Plate 1, is supplied through the contact *C* with the positive current, which passes through the same into the different contacts *N*, *S*, *E*, *W*, *A* and *B*, Fig. 1, Plate 2, to the red lamps which are inclosed with the different entry signs painted on the outside, as shown; thence it passes to the rail or other negative bodies. It is clearly seen that all the lamps have the current on them at all times except the one that is in the dead space. This space is clearly defined to the operator by the hand-wheel lugs *A* and *A'* (Fig. 2, Plate 1), which are placed opposite the marks on the upper drum plate *X* (Fig. 1, Plate 1). This affords a red or danger signal on all parts of the division except the one track that the train is traveling on; all other trains are held still until one gets out or to some point so that some other train can come in or go out with safety. It is exactly the same in Figs. 3 and 4, as the drum connections just described, only four lamps are used, *N*, *S*, *E* and *W*, instead of six. The contact *D* is the positive which touches the plate at all times, affording current to the different lights, etc., except when the dead space 4 (Fig. 4, Plate 2) is turned under the contact, causing the red light to be extinguished.

Operating the Lamps

The next step is the rail switches, *N*, *S*, *E*, *W*, *A* and *B*, Figs. 5 and 6, Plate 2, and lights *E*, *S*, *N*, *B*, *A* and *W*, on the operating board which are connected in multiple; they are connected essentially the same way, only the wheels of the train passing over the switch traveling toward the bottom cause the light to be displayed, which signifies that a train wishes to come in on the bottom system, and awaits the will of the operator to despatch same therein. When the operator chooses to let a train enter, he puts the lug on the hand wheel opposite the letter on the board as previously explained and this puts the red light out on this track and displays the red or danger signal on all the other tracks. In Fig. 6, only three lights and latches are used as the other lamp is close to the operator and he can see the trains approaching from the north.

The plate, No. 3, shows all the tracks in bold lines and the wires in small lines; the signals are indicated by small circles partially eclipsed, and the latches on the rail are represented by a line at right

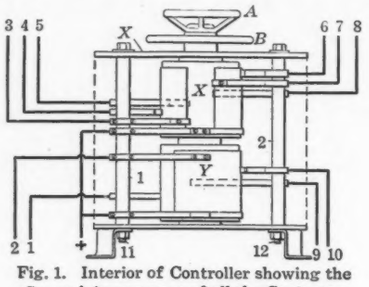


Fig. 1. Interior of Controller showing the General Appearance of all the Contacts, Drums, Contact Supports, etc.

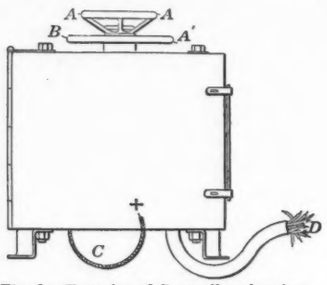


Fig. 2. Exterior of Controller showing Hand Wheels, Cables, Covering, etc.

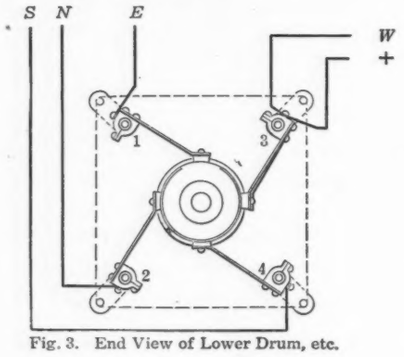


Fig. 3. End View of Lower Drum, etc.

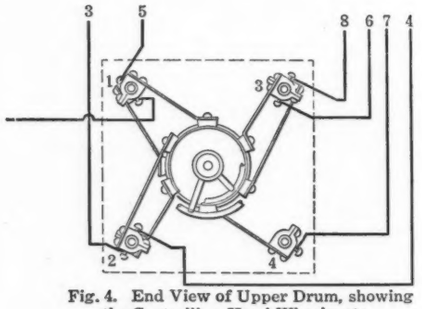


Fig. 4. End View of Upper Drum, showing the Controlling Hand Wheels, etc.

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Plate No. 1. Showing Controller and Wire Conductors Leading to Signal Lamps

angles to the track with the track sign nearby. The operator's station is between crossovers *A* and *B* and at the junction of Nos. 1 and 2 tracks opposite the hoist shaft.

Twelve Locomotives Can Be Handled

By following out the diagram, let us suppose a train wishes to come out of the east (north) which is signified by the closed latch switch and the light on the operating board, and another train is coming (empty) out of crossover *A;* the operator puts the lug on handwheel *A*, Fig. 1, Plate 1, opposite the *E* on No. 2 track through *B'* crossover and backs down through *A'* crossover and gets the empty trip and goes on its journey east. This plan is followed provided the west or north trains have not passed into the block onto No. 2 track; if so, the former may stay in the clear on No. 1 track (south) and the latter takes the same course as previously explained. In this way six locomotives on each side of the mine can easily and safely be handled by one man and all the trains kept moving, thus waiting on the hoist to get rid of the cars instead of the hoist waiting on the cars.

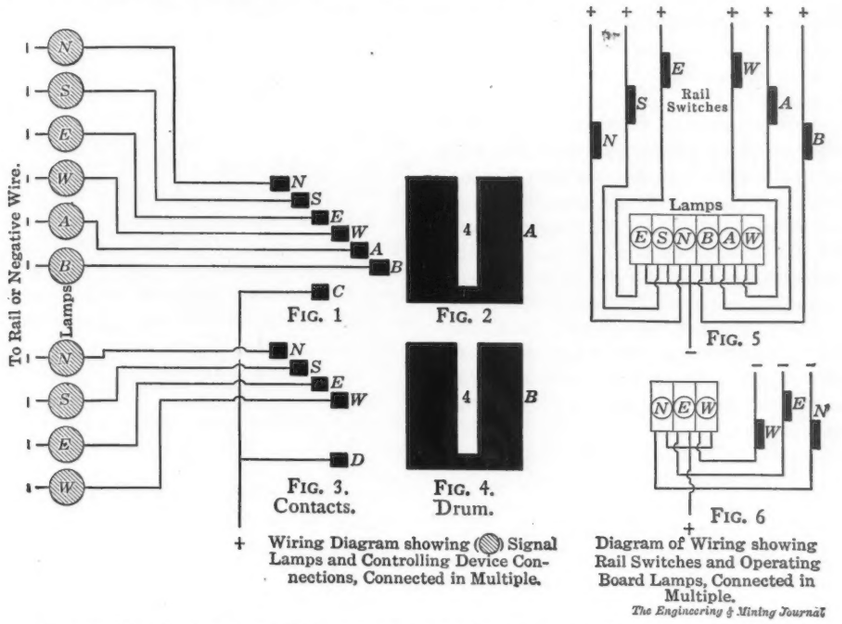


Fig. 1. Fig. 2. Fig. 5.
Fig. 3. Contacts. Fig. 4. Drum. Fig. 6.

Plate No. 2. Showing Details of Lamp System and Controlling Device Connections

The system is designed for either mule or locomotive haulage, but more especially for locomotive haulage, and there is no limit to the number of trains that can be handled around the mine bottom with safety; furthermore, all trains are handled by one man, which eliminates the danger of wrecks due to careless boys flagging. Any number of changes can be made to suit the conditions as they vary from time to time. The cost of installation is the only item of importance and this is a small matter compared with the saving in insurance of not having an accident. The question of doors, etc., is also a small item, as there are several ways to open and close same. I shall be pleased to communicate with anyone desiring further information concerning this system.

Scope of the System

Spitzbergen Coal

Since 1904 the Arctic Coal Company, an American corporation, has been extracting coal on the west coast of Advent bay, Spitzbergen. Two beds are being exploited, one situated 590 ft. above the sea, 8 ft. thick and the other at a hight of 785 ft., from 4¼ to 5¼ ft. thick. The coal beds are intercalated in hard and compact Miocene sandstones without any slatey layers. The seams are inclined about 4 deg. and undulate slightly, but are faulted. The coal is dry and of good quality. The operations have been prin-

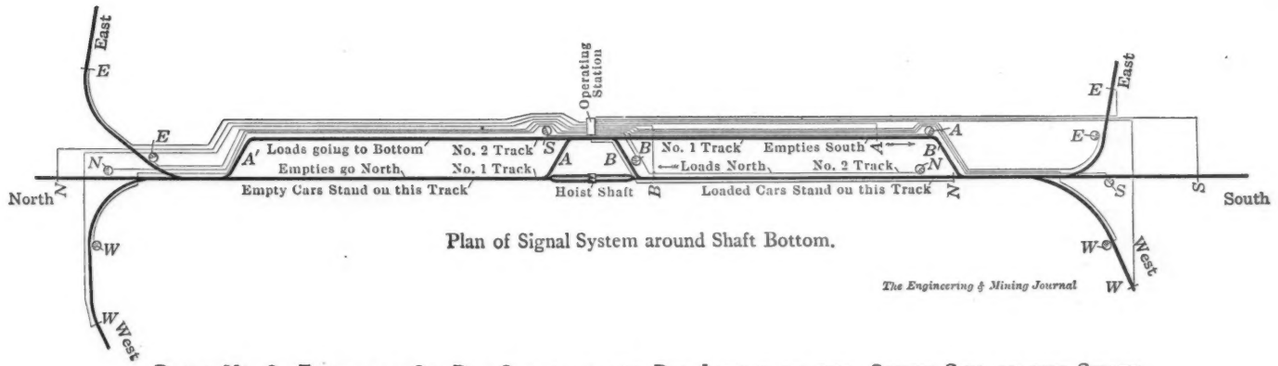


Plate No. 3. There are Six RailSwitches and Red Lights on the South Side of the Shaft

the board of the controller which extinguished the red light *E*, then the train comes out and up to signal *S* which is burning red and stops; when the other train clears the switch of crossover *B*, south, the red light is cut out on the No. 2 track north and the loaded northeast train, southbound, passes into the *B* crossover and onto No. 2 track and travels up same until the rear end has cleared the switch at *B;* then the locomotive cuts off and passes out of the

The locomotive trips can be either gathering or regular long haulage or both, but in either case the signal works perfectly. The loaded or empty track is long enough to hold as many as four 32-car trains at one time. A train could come out of the southeast and enter the block *N*, and wait for the danger signal to be cut out and then pass down to the crossover *B* and leave the cars and pass through the block *B* and await orders, which, if not given, shows that there is

cipally preparatory, so that the production during the summer of 1910 was only 5000 to 6000 tons, and the mine will not be in proper going order until June, 1911. It is then proposed to export the coal to Norway (*Min. Journ.* Feb. 11, 1911), which is destitute of that mineral. The 150 workmen employed are mostly Norwegians and are paid from 6s. 6d. to 7s. 3d. per day. They now work all the year round, although the engineer in charge is only there from June to October.

Modern Spad Work in Coal Mines

By Douglas Jones

A description of the methods employed to set lines so that miners can drive entries and rooms on a definite course.

In the early days of coal mining, when the rooms and entries were not systematically laid out, the faces of the workings took drifting courses, that is, the room or entry was driven in no fixed direction. As a result, a room breaking into the next one was not uncommon, and the size of the pillars varied from a few feet to even 100 ft. Then caves, squeezes, accidents and mine disasters were more numerous than today.

This was particularly the case in the anthracite coalfield. To this, perhaps, is due the present surface disturbance in the mining region of Pennsylvania. Then the system of mining was gradually changed, in that the mine foreman became the master of the situation. He was instructed to use a magnetic compass to determine the courses of the workings. The introduction of this simple instrument improved the system wonderfully. Yet, in some cases, the use of the compass was no better than the method used before its introduction, as the mine bosses were not always familiar with the manipulation of the compass.

During the compass system of mining, the entries or gangways were driven according to the contour of the bottom and the rooms or chambers were turned off the entries every 40 or 50 ft. Two holes 1½ to 2 in. in diameter and 2 to 3 in. deep were drilled according to compass, and these holes were plugged with sticks about 5 in. long. The miner then fastened strings on the sticks and the work started. In the latter part of the 80's, the mine surveyors were expected to put up lines for the rooms and entries, and the system gradually changed from the compass to transit lines.

The Present System

Today the lines are put up by an assistant transitman and his helpers. The outfit consists of a transit, a plumbbob, 50 ft. of linen tape, an iron sight-rod, a brace and ¼-in. bits, 3-lb. hammer, a jumper, spads, plugs ¼ in. in diameter and 2 in. long, and a ½-gal. oil can. Besides this outfit, the man in charge of the party has a blueprint of the workings and a notebook or two which contains the notes of late extension surveys. The courses and the position of the center lines of workings usually appear on the blueprint. The transitman generally sets up the instrument at the nearest station and scales the distance on the blueprint from the station to the "line;" then the distance is measured to a convenient point and a ¼-in. hole from 1½ in. to 2 in. deep is drilled with the brace-and-bit if the roof is slate or soft sandstone. The jumper and hammer are used for a hard sandstone roof. Into this hole is driven a wooden plug, which is then cut off level with the roof; into this plug a spad, which will be described later, is hammered.

The hole in the spad faces the instrument. The transitman takes the sight on the middle of the hole in the spad if it is visible, if not, he hangs the plumbbob in the hole and then measures the distance to within 0.05 ft. Then the transit is set up again under the spad just put up, and the transitman backsights to the first station; he then turns the telescope to a desired course.. On this course another hole is drilled about 4 ft. from the instrument and into the hole a spad is driven as before. He sights to the spad hole, and if the hole is not in the exact line, a tap or two will bring the spad to the required position. A line is then hung on each of the spads and the work is completed.

In case the station is at the foot of a room, two spads can be put in by one setup. When an undulation occurs on the floor of the working, the sight is obstructed from the spads to the face and it is then necessary to extend the lines close to the face. In such an instance the instrument is set up at one of the spads and the man at the instrument backsights to the other spad and carries the same course to the face. This is a quick method, but in many instances the spads are more or less disturbed. My personal experience shows that spads may be out of line all the way up to one degree for those in solid roof and even to 10 deg. for those in collars of props. For this reason I would advise the extension of old lines in any very important work.

In the accompanying illustration, the sketch at the top shows the relative position of the spads with respect to the roof for lines set for an ordinary room or entry. The ¼-in. hole drilled in the roof is usually 1½ in. deep for a 1⅜-in. spad, and 1⅞ in. for a 1¾-in. spad. The plug should be made of soft wood and should fit the hole tightly and should be made uniformly round, tapering a little at the end, otherwise the spad will be easily disturbed. I have made several good plugs out of an old dynamite box. The best distance between spads is from 3 to 5 ft. If too far apart, often the line is hard to be seen, if too short the face is likely to be out of line.

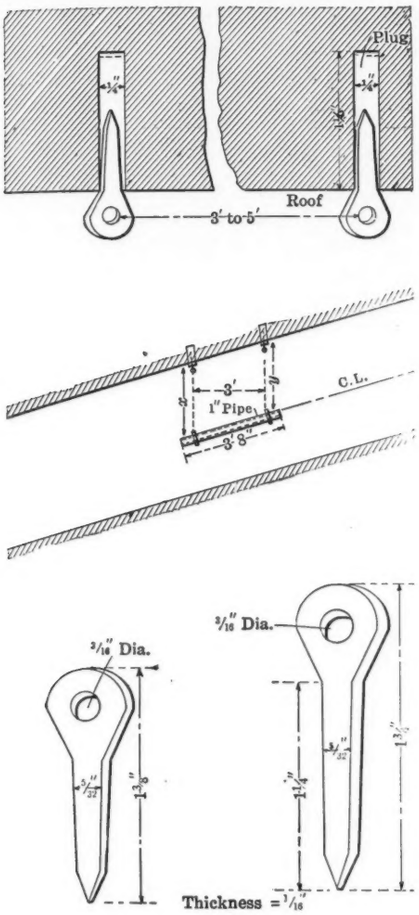
The sketch just below the one mentioned shows a section of a rock slope or rock plane, which requires the grade line as well as the center line. The spads are set in the roof as usual, but more securely. For this reason a larger-sized spad is used for the work. A 1¾-in. or 2-in. spad gives the best results. These spads are set about 3 ft. apart and the relative elevation of the spad holes is carefully determined by a level. Stout copper wires are used for the spad lines instead of twine, which is used in ordinary spad work. The length of the wires is usually half the distance from the roof to the bottom, but often it is a little shorter. At the ends of these wires, a 1-in. pipe is securely fastened, so that when the wires are hung on the spads, the lines not only hang parallel, but also the pipe takes the direction of the grade as well as the center line of the rock work.

When the man lines up the face, which is usually done at every cut, he sees the face through the pipe while a man at the face holds a lamp, moving back and forth, up and down until the light is in the line of the pipe. When this point is obtained at the face, the man marks a point on the rock, which is the guide for the next cut. He then takes the pipe and the lines off the spads and puts them away carefully until the next cut. The distances X and Y of the spad lines are usually given by the engineer in charge, who checks them every time he uses them. In some instances small iron plates about 3 in. square with a ½-in. hole in the center are used instead of the pipe, but experience has shown that the pipe is the better of the two, in that the pipe takes only one direction while the plates face all directions, so that it is very difficult to see through the holes.

Lines for Pitch Workings

Engineers are often called upon to set lines for developing pitch workings. In such cases it is next to impossible to set a pair of lines in the roof. Even if done, they are of little practical use, as the miner cannot use them, since he has to line the face either through the trap door or through the chute. The bottom sketch in the illustration shows the plan and section of a pitch working. Three spads instead of two may be used in such pitch work. First a spad is set in a convenient place, from which the face can be seen, in the roof, as shown by a in the sketch and the instrument is set up at the nearest station. Then sight is taken to the spad as usual and the transit is set at spad a; the transitman then backsights

to the station and turns the telescope in the line of working through the trap door or chute. He then, on the same course, sets spads *b* and *c* in the bottom rock. These spads *a*, *b* and *c* are connected by twines meeting at *d*. Since these points are in the plane of lines, the lines *b d* and *c d* of the spads *c* and *b* can be used as the lines for the working. These lines are removed when not in use.



THE SKETCH AT TOP SHOWS SPADS SET FOR ROOMS AND ENTRIES. THE SECOND SKETCH SHOWS SPADS SET FOR A ROCK-PLANE OR SLOPE

After the field work is done, these spad notes are plotted on a map in the office for the use of the foreman. Spads should never be set on collars, because the roof is often bad; spads can be reset, but the face driven on bad lines can never be rectified.

A day's work done by a party consisting of two men, in spad work, varies from four pairs up to 25 or 30 pairs of lines; it all depends on whether the work to be done is in one locality or scattered over a large territory. Taking a run of 12 months, 10 pairs of spads constitutes a day's average work.

The ordinary spads are made of iron, often they are called "horse-shoe nails." The third sketch in the illustration shows typical spads such as are used in the Pennsylvania coalfields. The smaller ones are used in the ordinary work, while the large size is used for special work. In a wet mine iron spads are destroyed in a few weeks by acid mine water. A peculiar feature of this destruction is that the acid attacks the surface around the hole much quicker than any other part of the spad, consequently the line hung on the spad soon falls down. For this reason there are spads on the market made of many different metals, such as copper, brass, tin, etc. The copper and brass spads give good results. The only objection to their use is the fact that brass and copper have salvage value which tempts the workmen to collect them for junk. If such a practice becomes general in a mine, the men will pull them out as fast as the surveyors set them. The cost of these spads is about $10 per 1000, which is a little more than twice the cost of iron spads. Recently iron spads plated with tin have appeared on the market. The price of these spads is about $5 per 1000. The tin-plated goods seem to work well, in that the spads resist the mine acid much better than do the iron spads. In a wet mine where an ordinary iron spad lasts only five or six weeks, the tin-plated spad in the same length of time shows no sign of being attacked by the acid water.

Prevention of a Dust Explosion

In a circular just issued by the Bureau of Mines, George S. Rice has discussed the problem of coal-dust explosions. In summing up under the head of "precautions," Mr. Rice says:

In a mine working a coal that makes inflammable dust, the risk of a dust explosion can be greatly lessened by following these precautions:

Use permissible explosives where the coal cannot be wedged down.

Don't use black powder, dynamite or any long-flame exposive.

Don't blast the coal "off the solid." Undercut it or shear it, and wedge it down if possible.

Don't drill the holes beyond the undercutting or shearing.

Don't fire two shots at once, except by electricity from outside the mine. Allow enough time between shots for the dust to settle.

When shots throughout a mine are fired after the shift by shotfirers, they should be fired on the last of the air first, then successively toward the intake, so that the dust and gases from the earlier shots will not be carried toward and possibly ignited by the later shots.

Don't tamp shots with coal dust, bug dust, or small coal, whether wet or dry. Use clay or other material that will not flame.

Load out all coal dust or bug dust from the working places and do not let it collect along the roads. It is dangerous in the mine; it has value as fuel outside.

Use tight cars and keep the coal below the sides of the cars.

Flush the tops of the loads with sprays.

Remember that a dry mine is a dangerous mine.

Wash the coal dust from the roof, ribs and timbers; or, if this is not done, keep the dust damp by making the mine "sweat" all winter as it does in summer; or else keep the coal dust covered with rock dust, clay, or similar material.

Don't be satisfied with having some parts of the mine wet.

Keep all the mine wet, so wet that the roof and sides are beaded with moisture and the dust packs down on the floor and looks wet.

COLLIERY NOTES

When an explosion occurs in a mine that produces a noncoking coal, few or no signs of coke will result from the explosion. In such mines, the dust will lose in volatile matter and increase in ash, so that the chemical analyses will furnish the clue as to the part played by the dust.

It is now generally believed that the direction of travel of a coaldust explosion can be partly determined by the manner and place of deposition of the caked or coked dust. The particles of coke are usually deposited on the reverse side of timbers or rib corners. The reason for this is that the excessive speed of the explosive blast is too great to allow deposition on facing exposures.

Speaking of the travel of a coaldust explosion, Mr. Rice in his report on American coaldust experiments says, "It is probable that where extreme speed is reached, the flame darts only to the center of the dust cloud, borne by the advance wave. When the explosive wave reaches an enlargement of the passageway or where side entries lead off, giving a large volume of air space, the excess dust may have opportunity for more or less complete combustion, giving a sudden burst of greater energy. Many observers have commented on the great explosive force often manifested at turnouts, overcasts and sidings.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

E. M. Flynn has gone to London in connection with Porcupine matters.

E. M. Hamilton is now on his way to England on a vacation trip for three months.

Frank Lee Norris, of Durango, Mexico, is in New York. His address is at the Engineers' Club.

Edwin Higgins is now manager of La Crosse mine near Randsburg, Kern county, California.

Dyke V. Keedy, of the firm of Dietz & Keedy, Boston, is in Virginia examining some iron properties.

John B. Hobson has returned to Victoria, B. C., much improved in health, after a month's visit to California.

H. Mortimer-Lamb, secretary of the Canadian Mining Institute, leaves Montreal this week to visit western Canada.

Ernest du Bois, of Véviers, Belgium, has been visiting and inspecting mines and plants in copper district of Lake Superior.

J. A. Dresser has resigned his position on the Canadian Geological Survey and entered the service of the Lake Superior Corporation.

S. M. Greenidge, of Cananea, Mexico, was in New York last week on his way to London on professional business. He will return about the middle of June.

Benjamin B. Lawrence is in British Columbia to examine the Hidden Creek copper mine, on Observatory inlet, Portland canal district, for the Granby company.

Charles A. O'Connell has been appointed manager of the Trethewey mine, Cobalt, in place of George MacNaughton, who resigned to look after his interests in Porcupine.

Sumner S. Smith, of Oakland, Cal., appointed mine inspector in Alaska by President Taft, is a graduate of the University of California. He is 31 years old and is well known in California and Utah.

H. R. Holbrook, formerly with the Balaklala Consolidated Copper Company at Coram, Cal., has been appointed chief chemist to the Mexican-American Smelting and Refining Company at Guaymas, Sonora, Mexico.

W. R. Freudenberger, for three years past electrical engineer for the Steptoe Valley Mining and Smelting Company at Ely, has been appointed engineer to the new Public Service Commission of the State of Nevada.

J. E. McAllister has resigned as general manager of the British Columbia Copper Company and will remove to New York, where he will enter a firm of consulting engineers. G. E. Warren, who has been smelter superintendent, succeeds Mr. McAllister as general manager.

W. Weston, of Denver, Colo., has gone to Silao, Guanajuato and Tampico, Mexico, on a professional trip which will take two months. He has opened a branch office at Calle de Aguacates, 14, Silao, Mexico, under the name of W. Weston & Son.

OBITUARY

James C. Fuller, surveyor and assayer at Le Roi mine, Rossland, B. C., met his death on April 10, as a result of having apparently drunk a solution of potassium cyanide in mistake for water. At the time of the occurrence he was alone in the mine laboratory. Mr. Fuller received his mining education at the Camborne School of Mines, Cornwall, leaving there to go to Rossland, with Anthony J. McMillan, managing director, in 1904. Ever since, with the exception of short periods spent in Rhodesia and Mexico, respectively, on professional business, he had been employed in various capacities at Le Roi mine, for several years as chief mining engineer. Latterly, operations at the mine being on only a small scale, he did the assaying. He was held in high regard by all with whom he came in contact, and the management bears testimony to his ability as an engineer. He was to have been married next June.

Alexander E. Brown died at Cleveland, O., April 26, aged 58 years. He was born in Cleveland. He was the son of Fayette Brown, who was president of the Stewart Iron Company, and prominently identified with other industries. Mr. Brown attended the Cleveland public schools, and in 1869 entered the Brooklyn Polytechnic Institute, Brooklyn, N. Y., from which he graduated in 1872. After graduation he was connected for several months with the United States Geological Survey, engaged on work in the Yellowstone National Park. For the next two years he was with the Massillon Iron Bridge Company as chief engineer. From 1875 to 1878 he had an office in Cleveland as a consulting engineer, devoting his attention largely to designing, building and selling bridges. In 1878 he became connected with the engineering department of the Brush Electric Company, Cleveland. While engaged as a bridge engineer, Mr. Brown took up the problem of developing machinery for the rapid and economical handling of iron ore from boats, and in 1880 organized the Brown Hoisting and Conveying Machine Company. He became vice-president and general manager of this company, his father being president. He succeeded his father in this office when the latter died in January, 1910. At first the company had its handling equipment made in other shops, not building its plant until 1886. In 1900 the name of the company was changed to its present form, and reincorporated. Mr. Brown built the first cable machine for handling ore from boats in 1879. This was placed in operation on the Erie Railroad docks in Cleveland. His next step was the building in 1883 of the first bridge tramway; also for removing ore from vessels to dock piles. This, too, was erected on the Erie docks in Cleveland. The many other improvements in hoisting and unloading machinery made under his direction are widely known both in the United States and Europe. He leaves a wife; also a son, Alexander C. Brown, who is a director of the Brown Hoisting Machinery Company, and a daughter. He was a member of the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the Civil Engineers' Club of Cleveland, the Electrical Engineers' Club and other organizations.

SOCIETIES and TECHNICAL SCHOOLS

West Virginia Coal Mining Institute—Summer meeting will be held June 18-19 at White Sulphur Springs.

Mine Inspectors' Institute of America — The summer meeting will be held at Charleston, W. Va., June 13-15 next.

Rocky Mountain Club—The banquet in honor of John Hays Hammond at the Waldorf-Astoria, New York, on the evening of May 10, was largely attended and was a successful affair.

Mining and Metallurgical Society of America—The following have been elected to membership: Ralph Arnold, Ross E. Browne, Joseph A. Holmes, Maurice B. Patch and Gardner F. Williams.

Kentucky Mining Association—A meeting is to be held at Lexington, May 29, for the purpose of organizing an association to promote the interests of mine operators and improve mining conditions. It is propesed to follow in a general way the lines on which the West Virginia association has been successful.

American Iron and Steel Institute—The annual meeting of the institute was held at its offices, New York, May 1. The following were elected directors for the three-year term expiring in 1914: J. A. Farrell, E. C. Felton, Elbert H. Gary, Charles M. Schwab and Powell Stackhouse. Mr. Farrell was elected in place of W. E. Corey. The others were re-elected.

Canadian Mining Institute—The Western Branch has called its tenth general meeting, to be opened at Trail, B. C., May 18. Robert R. Hedley, manager of the Hall Mines Company's plant at Nelson, B. C., has been nominated as chairman for the ensuing year in succession to William Fleet Robertson, provincial mineralogist. Papers on both coal and metal mining will be read and discussed.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

May 5—Of two State measures relating to the conservation and extraction of minerals occurring in the lakes and streams one is known to have been approved by Governor Johnson, and the presumption is that the other also has been approved, since each is dependent upon the other for its practical legal effect. These acts provide that minerals contained in such waters may be extracted only by lease or express permission for a period not to exceed 25 years, and for the withdrawal of State lands within the meander lines of streams and lakes known to contain mineral in commercial quantity. Application for lease must be approved by the surveyor-general of the State within 90 days after the survey has been completed by the county surveyor; all leases shall contain reservation of right-of-way to the State, and to individuals who may lease such rights upon the same rental terms as the lands; the further reservation is made that any city may appropriate and take water from any stream or tributary considered in this act.

The rental to be paid for these leased lands and rights of way shall be $2.50 per acre; but the act does not prescribe the number of acres of lands to be held under one lease, though it does prescribe that the width of any right-of-way shall not exceed 100 ft. The royalty prescribed is 25c. per ton of 2000 lb., except for sodium bicarbonate and sodium hydrate, on which the royalty is 50c. per ton; the money thus received as rental and royalties shall be paid into the State school-land fund. The preliminary cost to the leaser includes only the cost of survey and a filing fee of $10. Leases may be abandoned upon 60 days notice, but provided that payment of royalty for the full calendar year, ending Dec. 31, within which notice is given, must be paid. The legislature shall have the right to change the rental or royalty only after 10 years subsequent to the passage of this act; and any lease shall terminate at the end of the fiscal year if the lessee or assign shall not have extracted from the water or land an aggregate amount of mineral equal to 5 tons per acre of the land leased within the preceding year. The 25-year life of the lease may be extended for a like period upon such terms and conditions as may at the expiration of the initial term be prescribed by law.

The act approved by Governor Johnson to regulate and limit the appropriation of water for generating electricity will require a strict accounting from the power companies hereafter established and from present operators who may contemplate extension of activities. The power companies present and prospective are required to proceed with diligence to make proper use of waters appropriated or the same will be declared unappropriated. If after six months the board and any objectors are satisfied the applicant is granted a license to go ahead and appropriate, after having paid an application fee of $10 and a license fee of $100, and an annual rental fee in advance based on theoretical horsepower, at the rate of 10c. per 100 for all above the first 100 horsepower.

Denver

May 7—The Moffat Tunnel bill passed the House of Representatives as amended by the Senate. It is now before the people to vote the $4,000,000 bonds at the next regular election. The bill carried an agreement that should the tunnel be built the Moffat road will build on to Salt Lake City or connect at Dorset with the Denver & Rio Grande, thereby assuring a western terminal.

The output for April of the Cripple Creek district was $1,365,130, which was not quite as large as the output for March. The drainage tunnel is now lowering the water as rapidly as was expected. Contracts for sinking over 50 shafts, ranging from 200 to 500 ft. in depth have been let. With Cripple Creek's low mill, railroad and smelting charges, there will be considerable revival in low-grade properties.

Butte

May 5—On May 2, the first test was made on the Mountain View hoisting engine of the use of compressed air. The engine, which has been entirely remodeled, has had its cylinders enlarged to over twice their former capacity in the use of steam, and in order to ascertain if all the parts had been correctly assembled, the air was turned on, the engine responding quickly and easily to its power. As the shaft is not yet in readiness for the hoisting of ore with skips, no further test of the air for the purpose of noting how it will act for hoisting purposes, will be made for some time yet, but the first long step was made on May 2, when it was proved that the engine would work smoothly and easily, both at low and high speed, and it seems practically assured that the Anaconda mines will soon be operated at a great saving by the use of this new power.

Joplin

May 5—The outlook for 1911 in the Joplin district is promising. While market conditions have not been the best for the past few months the production has been large, averaging so far only about 10 per cent. less than 1910.

The contract system of the Zinc Ore Producers' Association has resulted in the pledging of about 3000 tons of second-grade ores a week, and puts this class of ore at the sheet-ground mines on a more stable basis. The development in the district has been almost entirely in the soft-ground territory.

The purchase of the 640-acre Quinn tract, at Webb City, by the American Zinc, Lead and Smelting Company, is the only new development in the sheet-ground territory. This means the systematic development of a large acreage, the reduction of royalties and the probable opening of several new mines by the largest company in the district.

In point of production from new camps the North Fork camp, at Neck City, still is in the lead. The limits of the camp have not extended as rapidly, however, as has been expected, and at the present time anly about one square mile has been developed.

The Toms Station camp, near Joplin, has shown the most remarkable development and brought in some of the richest strikes ever made in the district. Already four square miles have been developed and 14 prospect drills are in the field. Without exception the strikes have been in soft ground and the ore in almost every instance is of the highest grade. Two new mills are already in operation and several others in process of erection. The ore in the Sitting Bull mine, and that of Chapman & Lennan eclipse anything yet found in the district, the ore from the Sitting Bull running over 50 per cent. The Lehigh camp, at Carl Junction, is showing renewed life, and much prospecting is being done. The United Zinc Company is about to begin the erection of a large mill there.

In Kansas, the Galena camp is coming to the front again through the reopening of old tracts by large companies. The Playter interests are investing heavily in this field and have built several new

mills. Little extension of the limits of the camp is noted, however. The most northerly camp in the district, Lawton, has beeen reopened and a large mill erected. Rich ore has been found by prospectors on many tracts near there. The character of the ground and ore is similar to that in the Peacock camp.

The Oklahoma camps show little life. In the Quapaw camp, the Petersburg company has erected a 500-ton mill, but the ore is thin and the success of the venture problematical. The Mission mine has been subleased and operations resumed. At Miami no new work is being done, aside from the three deep shafts in the north end of the camp, none of these are yet producing. The old mines are still producing and selling their lead and a little zinc ore, but holding the bulk of their zinc ore for a better market. There has already accumulated a surplus of about 3000 tons in this camp alone.

Taken as a whole the Joplin district is in a very promising condition. Outside capital is slow in coming in, but development is being done by local investors and operators.

Birmingham, Ala.

May 8—The following announcement was given out the last of the past week by Vice-President F. H. Crockard, of the Tennessee Coal, Iron and Railroad Company: "Having completed all our rail contracts available for immediate rolling, it is necessary to suspend temporarily the operations of the Ensley rail mill, April 29. It is not probable that operations will be resumed before June. There are several contracts under negotiation which, if closed, may alter the situation. The Ensley blast-furnace department will continue to operate two furnaces. No change is contemplated in the status of the Bessemer blast furnaces. Orders now on hand seem to indicate a continuance of operations at the Bessemer rolling mills. The present large construction forces on new work will be continued without interruption. Every effort will be made to maintain the ore- and coal-mining departments on the present basis of production."

Indianapolis

May 8—The Indiana coal miners are holding mass meetings in several of the mining districts to express their disapproval of the miners' qualification act passed by the recent legislature. Standing committees have been appointed with instructions to consult attorneys regarding the probability of having the qualification act declared unconstitutional. Two of the principal objections to the act are the obligation to take the examination and the places for holding the examinations. The miners insist that the examinations should be held at the mines instead of at the county seats, because too much time and money are lost in making the trips to take the examination. The miners who have a two-years record and are exempt from taking the examination, but are required to have a certificate from the examining board, are likewise displeased because they must apply in person for a certificate and pay a fee of $1 therefor.

Duluth

May 7—Indications point toward the organization of the miners on the Iron ranges, as an affiliated branch of the Western Federation of Miners. The vice-president of the latter organization passed through here recently on his way to the Mesabi range, and the statement made by him at that time indicates that it is his purpose to note the conditions on the range with the object of organizing the miners. In 1906, the Western Federation succeeded in gaining a foothold on the Minnesota ranges, but the unsettled conditions which followed the panic in 1907 succeeded effectually in putting a damper on the plan until now. The Federation has organizations in both the iron and copper countries in Michigan, but as yet it has not brought itself into prominence in any way in the latter places.

Cobalt

May 4—The Temiskaming & Northern Ontario railway commission has signified its intention of running an accommodation train as far as the Frederickhouse river, where connections for Porcupine can be made with the boats. This will be of great assistance in handling freight and passengers, although it is doubtful if any more heavy machinery will be brought into the camp until the railroad is finished. There are over 1000 men at work on the line, and all the indications point to its being finished by the first of July.

During the last few weeks, encouraging reports have been coming down from the Cripple Creek section. This district was discovered last summer, but owing to the absence of spectacular gold showings as in Porcupine, it has been little in evidence. Considerable work has, however, been done, and in some cases the results have been satisfactory. During the coming summer these properties will be systematically developed, as the water route into the district is quite easy.

During the last week, new Porcupine mining companies, having an aggregate capitalization of $17,500,000, were granted charters.

The continued soft weather and the rapid rise of the water in the Montreal river, is rapidly clearing out the ice, and it is expected that boats will be able to run into Elk lake by about May 10. Shipments from this section during this season will probably exceed those of 1910. There are now three Gowganda mines on a shipping basis and when the concentrator at the Millerett is completed shipments from that property will be largely increased. Owing to the high freight rates only high-grade ore can be shipped, and this company has a large tonnage of medium-grade ore available for concentration. As an evidence of the difficulties under which mining is carried on in this section a recent investigation showed that freight transportation cost on an average about 60 times what it would if there were proper railroad facilities. So far, with only a few exceptions, results in Elk lake and Gowganda have been extremely disappointing. The possibilities of the district are not, however, by any means exhausted. Silver has been found over an area of approximately 5000 sq.m. and careful prospecting and systematic development, will undoubtedly result in the discovery of paying properties. This section has suffered greatly in comparison with Cobalt, and when the boom was on, companies were formed with an entirely inadequate supply of working capital, considering the high cost of mining and the difficulties of transportation. Partly on this account and partly on account of the very limited extent of most of the orebodies encountered, the great majority of companies have proved to be failures.

The annual report of the Nipissing mines, which will be patented shortly, will show a greatly increased production over previous years, and also increased ore reserves. During the last year 5,597,778 oz. of silver were produced at a cost of $816,980, leaving a net profit of $2,167,103, or 72.62 per cent. of the gross production. In estimating the value of the ore reserves, the high-grade ore only was considered, no account being taken of the low-grade in the mines or on the dumps. The ore reserves are valued at $3,276,440. The cost of producing silver was 14.71c. per oz. and the average price received was 53.48c. per ounce.

Toronto

May 7—The German Developing Company has just purchased, through Martin Nordegg, managing director, two square miles of coal lands close to the Canadian Pacific Railway main line on the Kanaskas river, Alberta, the sellers being J. B. McLaughlin and T. A. Beament, both of Ottawa. It is stated that a high price was paid. The company has already invested about $1,000,000 in Canadian mineral properties, and is pursuing a policy of acquiring areas at points which will be easily accessible to the railroads. It holds extensive areas in the West lying between the Grand Trunk Pacific and Canadian Pacific lines, a distance of over 200 miles, the most important of its coalfields being situated on the South Brazean. The German Developing Company is financing the road that is being built by the Canadian Northern from Seattle to the Brazean country.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

Regular steamship service will be established between Nome and Seattle and other ports, commencing June 4. Regular service is now in effect on the Copper River & Northwestern Railway between Cordova and Kennicott, a distance of 197 miles. The rates on ore range from $5.75 per ton to $33.70 per ton, according to the value of the ore, and include railway transportation to Cordova, and steamship delivery to Tacoma.

Hemple Copper Mining—This company expects to be shipping ore in 60 days. The tunnel is in 720 ft. S. A. Hemple, Landlock, is president.

Arizona

Cochise County

Directors of the Denn-Arizona Copper Company met, May 10, at Duluth to consider a merger of their property with the Shattuck-Arizona Mining Company. Both properties are under the same management and are organized under Minnesota laws. The lands of the Denn-Arizona Copper Company comprise about 200 acres immediately north of the Junction shaft of the Superior & Pittsburg property and are not far from the Shattuck-Arizona property comprising 120 acres about a half mile from the original openings of the Copper Queen and to the north of Calumet & Arizona.

Gila County

Miami—The fourth mill unit will start soon. Three units are now handling a little more than 1400 tons daily, and shipping 50 tons of concentrate per day. Although shafting is being placed it has not yet been decided whether Burch rolls or chilean mills will be installed for the fine crushing.

Live Oak—Hole 51 is 1057 ft. deep and still in 2¾ per cent. ore. Hole 33 is still in the capping. No. 55 is 315 ft. deep and still in ore. Hole 57 has just been started in the southwest corner of the property. No. 56 will soon be started. Shaft No. 2 is 104 ft. deep, its rate of sinking being the record for this district. It was sunk 12 ft. in one day.

Warrior—The leaching plant has been destroyed by fire. Estimated loss, $25,000.

Maricopa County

Relief—This gold mine near Phœnix is developing on the 400-ft. level. It is expected to start the mill soon, George Hamlin is manager.

Santa Cruz County

L. W Powell, Capt. James Hoatson and William McDermott have formed a corporation to be known as the Powmott Development Company, and have bonded the Montana group of mines, owned by L. R. Zeckendorf in the Oro Blanco mining district. It is the intention of the company to begin operations in a small way. The ore from this property is a lead-silver ore carrying a little gold and some zinc, and it will require concentration. The Montana group lies about two or three miles northerly from the Old Glory group, now being worked by Colonel Posey.

Yuba County

Marc Antony—The old crosscut in this mine, at Smartsville, has been prospected and other development work done during the winter, exposing three separate veins. A stamp mill is planned by the new owners, who have incorporated the Marc Antony Gold and Silver Mining Company, represented by W. W. Warren, Marysville.

California

Butte County

A dry-land dredge will be operated on lands of the Bank of Rideout, Smith & Co., of Oroville, situated on the Cherokee road. The boat is under construction at Los Angeles for L. N. Hearn. This type moves on rails and operates a steam shovel in the stead of a bucket line.

Nevada County

Fruitvale—Extensive development with machine drills has begun on this mine at Moores flat. A. Fitzgerald, superintendent.

Numitor—A continuous orebody has been opened in this mine at Chicago Park of sufficient grade to warrant steady operation of the stamp mill.

Placer County

Middle Fork—Superintendent Tregidgo purposes operating this property at Rocky Chucky with a dredge.

Laird—A tunnel is being driven on this mine at Yankee Hill. The gravel is cemented and runs as high as $50 per ton.

Plumas County

Gold Mountain Hydraulic Company—A restraining dam is under construction at this property near Bucks ranch. A storage reservoir and 1½ miles of pipe line have been completed. N. H. Frills, of Quincy, in charge.

San Diego County

Lower California Onyx Company—Articles of incorporation have been filed at San Diego by San Diego and Los Angeles capitalists, for working of onyx deposits in Lower California, 22 miles from tidewater, recently prospected by J. V. Smale, of San Diego. Capital stock, $200,000.

Shasta County

Mammoth—Two new orebodies have recently been exposed; one which was cut by a drift for a distance of 165 ft. assays 4½ to 5 per cent. copper, which is erroneously reported to be better grade than the original orebody. While the first ore was below this average there was considerable ore mined in the original workings that averaged 10 per cent. and much of it that ran as high as 20 per cent. The other orebody recently encountered is in that part of the property known as Section 29; this orebody is much smaller than the first named, but the copper reaches 26 per cent. It is too early to offer an estimate of the average from these two bodies.

National—A vein of free-gold ore has been exposed in this mine on Churn creek, paralleling the tunnel driven by former owners, who had abandoned the property.

Tuolumne County

Keltz Mining Company—Two new concentrators are being installed, roads built from the Miller shaft to the mill and the flume is being repaired. Work is being rushed and the 15 stamps will be dropping soon. H. H. McIntyre is manager.

Colorado

Clear Creek County

A company has been organized and a site secured near the portal of the Central tunnel for the erection of a Partridge furnace of 50 tons daily capacity.

Gambetta—This mine is shipping a 50 per cent. zinc product to Oklahoma.

Waldorf—The 200-ton concentrate plant is running 12 hours a day.

Vidler Tunnel—Manager A. J. Woodruff has discontinued work on the property on account of shortage of coal. It is the intention of this company to work in both headings to hasten the 1600 ft. of

connecting work. The western portal is in Montezuma.

Creole Belle—The owners of this Golden smeltery have taken a lease and option on this mine in the Lamartine district.

Capitol—A dozen sets of leasers on the Capitol are shipping ore. A night shift will probably be put on. All ground above the 300-ft. level is on company account. The main tunnel will be extended to another lode soon.

East Guffni—The old East Guffni is working under the leasing system and has opened an 8-in. streak of lead-zinc ore.

Lebanon—This group, on Republican mountain, regarded 40 years ago as the richest silver mines in the country, has been sold to the Clear Creek Holding and Mining Company, controlled by New York capital. The property transferred embraces the Lebanon group of 29 claims and six mill sites, and Everett group of 29 claims and six mill sites.

LAKE COUNTY—LEADVILLE DISTRICT

The old Cache creek placers at Granite said to have yielded $5,500,000 in gold at the time of their discovery in 1859 will be worked again this summer by a London syndicate. Dredges will be used.

Robert Emmet—A 30-ft. orebody of zinc sulphide has been opened in this property in Stray Horse gulch, with the average grade of 30 per cent. zinc.

Iron Silver—Extensive exploration has been done from the eighth level of the Tuscon shaft with satisfactory results.

SAN MIGUEL COUNTY

Japan Flora—This old property was shut down in the winter but will resume operations soon.

Black Bear—Forty men have been put to work retimbering and getting the mine in shape for an active summer campaign. E. J. Carter is manager.

TELLER COUNTY—CRIPPLE CREEK

Vindicator—A deal has been closed whereby the Vindicator Consolidated company secured control of the Christmas company, operating in the Cripple Creek district, by purchasing 600,000 shares of Christmas stock for $60,000. The Christmas property lies immediately north of the Golden Cycle and west of the Vindicator, and has been worked by lessees, who have been shipping about 25 cars of ore a week, worth $40 per ton. The Vindicator company recently brought suit to recover $75,000 worth of ore alleged to have been taken from Vindicator ground by the Christmas lessees. This suit has been amicably disposed of by the sale of the Christmas control to the Vindicator.

Rose Nichol Gold Mining Company—Operations have been resumed on this property under a four-year lease to W. C. West.

Michigan

COPPER

Hussey-Howe Mining Company—This company has completed its organization and consists of 160 acres of land owned by the Hussey-Howe estate and a like amount by C. A. Senecal. The tract lies between the Bohemia and Indiana tracts. The sandstone traverses these lands and on the Senecal tract a promising outcropping is easily traced near the sandstone. Trenching on this formation will be started in the near future and drilling operations will follow. No stock will be offered at the present time.

Copper Range Consolidated—This company will offer 10,000 shares of its treasury stock in exchange for the Atlantic property on a basis of 1 share for 10.

Ahmeek—Judge R. C. Flannigan, in the absence of A. T. Streeter, judge of the 12th judicial district of Michigan, modified the restraining order that was issued by Circuit Court Commissioner Marsh on behalf of Waldemar Chadbourne, heir of the late Thomas L. Chadbourne, so that a formal vote on the merger can be taken at the adjourned meeting. This is the last company to act formally on the proposed marger, all of the other companies voting in favor of it by a number above the requisite number.

MENOMINEE IRON RANGE

The Breitung interests have in contemplation the development of an important deposit in the Randolph district.

Roger—At this mine, in the Iron River district, operated by the Rogers-Brown Iron Company, a concrete shaft is being sunk. The shaft is circular in cross-section and is being lowered by the drop method. This is made necessary by the nature and depth of the overburden, which is principally quicksand and 135 ft. deep. No compressed air has been used as yet, the weight of the shaft itself being sufficient to force it downward, as the sand is excavated from the center by means of a derrick and a clam-shell bucket. Unless something unforseen occurs it will probably not be necessary to use air until the rock is reached and the process of sealing is commenced. This stage should be reached early in June.

Armenia—This mine, owned and operated by Corrigan, McKinney Company, of Cleveland, has installed an electric-haulage system, planned to take care of the tramming both underground and on surface.

MARQUETTE IRON RANGE

Portland—At this open-pit mine, in the Michigamme district, owned by the Rogers-Brown company, the Hoose & Person Construction Company, of Iron Mountain, Mich., has the contract to mine and ship the ore, and is preparing to resume.

Minnesota

CUYUNA RANGE

A new find of ore is reported on the north side of Rabbit lake, about a mile from the town of Cuyuna. A townsite has been platted in the vicinity. This new find is across the lake from the Kennedy mine.

It is reported that the extension of the orebody from section 17 to the east has been located on the S.E. of the N.E. and the N.W. of the S.E. of section 17—T 46 R 29. The property was purchased some time ago by R. J. Sewell, of Crosby, and a company was formed, including C. W. Potts, of Superior, secretary; H. J. O'Brien, president, and J. T. Murphy, treasurer. Doctor Sewell is vice-president. A union hole has been drilled on the east property line, in conjunction with the Williams-Brown interests. Drilling will be continued.

Inland Steel Company—This company is sinking a shaft in the W. ½, NE. of Sec. 11 T 46 R 29, one-quarter mile west of the town of Crosby. The fee is owned by George H. Crosby.

Cuyuna-Mille Lacs Iron Company—This company has secured an option to drill on the NE. of Sec. 27 T 15 R 30, and will commence operations soon. This 160 acres is generally supposed to lie in the center of a well mineralized area and the results of the drilling will be awaited with interest. The company also has drills operating on Sec. 3 T 46 R 29 and on Sec. 10 T 44 R 28.

MESABI RANGE

Iron Mountain Mining Company—Iron running 50 per cent. has been found by this company on its 40 acres in Sec. 20 T 58- R 19. This ore was encountered at a depth of 240 ft., which depth was much shallower than was anticipated. It was expected that this grade would be found at a depth of 400 ft. The ore is similar in grade to that found in the Grant mine a half mile away.

Leonidas—The stripping will be continued and it is probable that the work will be completed by the end of the season. Several steam shovels will be engaged in removing the ore from this pit.

VERMILION RANGE

Vermilion Iron Development Company—This company developing the Pine Island property has ordered an electrical equipment for drilling and lighting purposes. The equipment includes an engine and generator and drills.

Marquette & Vermilion—An extensive campaign for exploration is being planned. A test-pit crew will soon be started, to be followed later by a diamond drill. The company's land is in the S E of Sec. 19- T 62- R 14.

Chandler—This old mine, supposed to be worked out, is being reopened. It is

reported that there are 30,000 tons of high-grade ore on the stock-pile and over 100,000 tons in sight on the 160-ft. level. There are over 60 men working and the output is about 200 tons per day.

Almar—The main shaft is down 80 ft. The plan is to continue the shaft to 150 ft. and then to crosscut south to the formation. A compressor and three drills are on the ground and work will be pushed rapidly.

Montana

Butte District

Anaconda—The company is steadily progressing with the work of installing compressed air to take the place of steam. At the Pennsylvania mine it has been decided to stop driving the south crosscut on the 1800-ft. level; and to further develop the country, a diamond-drill hole will be run from the present face of the crosscut. For some years the Pennsylvania mine water has been pumped to the 1200-ft. level and then piped by a roundabout way through the Pennsylvania, Mountain View and West Colusa 1200-ft. levels, over to the main pumps at the Leonard mine, where it is pumped to the surface. Now a crosscut will be run on the 1200-ft. level, which will hole into the Tramway mine, for the purpose of making a new and much shorter course for the water, which will be carried into the Tramway flume and thus to the Leonard pumps. The ore hoisted from the former Butte & Boston mines, comprising the East and West Gray Rocks, the Silver Bow and the Berkeley, is about 35,000 tons at present, of which 12,000 tons and 7500 tons are hoisted from the East and West Gray Rocks respectively. At the Silver Bow and Berkeley mines, work is confined almost exclusively to stoping, and very little development work is being done. At the West Gray Rock preparations are being made to extend the shaft from the 1100-ft. level to the 1300-ft. level by raising from the 1300-ft. level. At the East Colusa mine the work of extending the air-shaft from the 1200-ft. to the 1300-ft. level has been commenced. A winze has been sunk from the 1800-ft. to the 1900-ft. level on the vein at the West Colusa mine, and drifting, both east and west from the bottom, has been carried about 40 ft. showing an unchanging body of good ore.

Deerlodge County

The Georgetown district is awakening to great activity. Many new properties are being opened, and a number of mines which have not been worked for years, are being prepared for mining again. There is said to be a daily tonnage of 500 tons at the present time, and with shipping facilities improved, this will be increased. It is practically assured that a railroad will be built to the district soon. The following mines will begin shipping ore to the Washoe smeltery as soon as the roads can be used: Hidden Lake, Venezuela, Cld Bonnanza, George, Roundup, Oro Fino, Holdfast, Montana, Twilight, and the Cochran group.

Oro Fino—On April 22, a new lead was struck on the 200-ft. level of this mine at Georgetown, and the lead has been cut disclosing ore averaging $40 a ton, mostly gold.

Roundup—Work is progressing steadily at this mine of the George Hill Company, and it is reported that a rich strike has just been made there. The shaft is down 285 ft. and an incline winze has been sunk 100 feet further.

Trilby—Messrs. Drumgoole, Tuchscherer, Ehlert and Nell, of Anaconda, owners of this mine in the Georgetown district, will begin operations.

Nevada

Lincoln County

Ernest R. Woolley, who planned the merger of the Nevada-Utah, the Ohio-Kentucky and the Prince Consolidated, visited the Pioche properties of the Nevada-Utah recently. While admitting that the deal in question was off for the present, it is reported he intimated that he could prevent operations by the Ohio-Kentucky and the Prince until such time as they were willing to come to his terms. Further, he is now planning another merger, namely of the Nevada-Utah Day mine with the Bristol Consolidated, in the consummation of which he should encounter no difficulties. Outstanding bonds of the Bristol Consolidated, held by the California-Nevada Copper Company, to the amount of about $200,000, mature this month, and as the proposed deal would avoid a receivership, it should go through very easily. The Nevada-Utah would probably include the Pioche-Pacific railroad in the deal, and access to this railroad by a tunnel 1½ miles long, instead of by a very steep nine-mile wagon haul, would make a big difference in the profits from the Bristol orebodies. The fact that every foot of the proposed tunnel will be rational development work of property controlled by the two companies, is also a powerful incentive. Last month, the Day mine, under the management of H. C. Parker, shipped 57 cars of ore, and should exceed that amount this month. The Pioche Coalition, a recent merger in which Solon Spiro is interested, has resumed work on its Golden Prince property. The Pioche X-Ray, of which Joseph Taylor is manager, will resume work May 15.

Lyon County

Mason Valley—Construction of the smeltery at Thompson is proceeding. The foundations for the blast-furnace building and also for the blast furnaces have been completed, and are awaiting the steel structure and the furnaces. The large receiving ore bins and the coke-storage trestle have been finished, as has the railway-trestle approach. Machine shops, blacksmith shops, officers' quarters and a 300,000-gal. reservoir are also completed. Underground the work has been confined chiefly to developing the stopes on the third level. Some experiments are now being carried on in connection with the breaking down and the best method of handling this ore, also some tests using the different kinds of powder. At the mine the orebodies are well opened up, and are practically ready to begin production.

Storey County

The total output for the Comstock district is estimated at $50,000 for the week ended May 8, including shipments made by Mexican, Ophir, Con Virginia, Crown Point, Belcher, Yellow Jacket, Gould & Curry, Chollar and Potosi companies.

General Manager George B. Burbank, of the United Comstock Pumping Association, has returned from the East, where he went relative to securing estimates for a new pumping plant on the 2650 station of the C. & C. shaft. It is proposed to put in an auxiliary plant at that point, and unwater the lode to the 3000 level and even deeper as conditions warrant. Important announcement is expected soon as to the details of the new plans.

Crown Point—This mine during March, according to an official statement, made sufficient net profit for the month on ore shipped to the Yellow Jacket mill to clear all mine and general expense with a margin to spare. The ore came from the 1400 level of the mine where new territory is being opened. The Belcher mine, adjoining, will soon start work on the 1400 level, working through the Balcher shaft, an air connection having been made with the Crown Point workings.

Mexican—The output of about $20,000 for the past week was the highest in the history of the mine. The total output from development in the vein on the 2400 and 2500 levels of the property has been $35,000 in two weeks. This ore has been taken out only in blocking out and prospecting the vein, no effort having been made at stoping. The stoping area on the 2400 level has been proved to be 100 ft. long to the south, with no explorations yet advanced to the north. Car samples last week exceeded $100 to the ton from the 2500-level two-compartment raise, and from the north drift on the 2400 level.

Chollar—The company has taken a lease on the Brunswick lode company of the same name, and is running a west crosscut from the Comstock tunnel connecting drift to a point under the incline shaft of No. 2 surface workings. This crosscut will be connected with the in-

cline, and the ground prospected under the ledge developed in the early days near the surface.

WHITE PINE COUNTY

Ely Consolidated—This property has been sold at sheriff's sale for $48,000, being slightly less than the judgment to E. P. Vandercock.

Oregon

BAKER COUNTY

Rainbow—The initial payment of $200,000 was made, May 3, on the Rainbow mine, in Mormon basin, by the U. S. Smelting, Refining and Mining Company. The total purchase price is $750,000.

Blue Mountain—This property near Sumpter is temporarily closed during the erection of a 100-ton concentrating mill, work on which will begin in June. C. L. Arzeno, Cincinnati, Ohio, is manager.

Golden Chariot—A concentrator is being installed in this mine, owned by Connor Brothers, Sumpter.

Success—Active operations will be resumed at this property, which has been closed for three years. The mine is owned by W. T. Woodford, Sumpter.

JACKSON COUNTY

Oxley & Baker—This company is considering the erection of a power plant and smeltery on the property at Gold Hill.

Utah

BEAVER COUNTY

Red Warrior—The capital has been increased from 150,000 to 250,000 shares, par value $1. The stockholders are being offered 30,000 shares of treasury stock, being allowed to subscribe for 1 share for every 5 shares of stock now held.

Cedar-Talisman—Development is being pushed on the 500 level for the contact between limestone and granite, where deposits of shipping grade are looked for. The management reports that in drifting to the east, what appears to be the old Stallworth vein has been cut.

South Utah—In March 23,972 tons of ore, or an average of 799 tons per day were milled, giving 2301 tons of concentrates, which were shipped to the International smeltery at Tooele. From these concentrates there were recovered 300,007 lb. copper, 2583 oz. silver, and 141 oz. gold. During the month a quantity of low-grade dump ore averaging less than 1 per cent. copper was treated, which lowered the general average. The company is producing at the rate of about 4,000,000 lb. of copper annually. The ore treated yields an average of about 15¼ lb. copper, and 17c. in gold and silver, or a total of $2.08 per ton. When the concentrator can be operated at its full capacity of 1000 to 1200 tons daily, it is thought a slight profit can be made with the present price of copper. Experimenting has been in progress for several months regarding some changes in the milling process, and Janney classifiers are being installed.

Utah United—Operations have been resumed. A contract has been given to continue the shaft to the 500-ft. level.

Blackbird—New equipment is expected from the east in May. This is a combination gasolene hoist and compressor plant, the working of which will be watched with considerable interest.

BOX ELDER COUNTY

Alpine-Galena—Iron ore spotted with galena has been encountered at this property near American Fork. The ore was taken from a vein about 15 ft. from the surface. A tunnel is being driven to cut the vein at greater depth, and will be continued 300 ft. to cut a second vein, which outcrops farther up.

SALT LAKE COUNTY

Ohio Copper—Sixty Deister No. 3 slime tables have been ordered for the mill at Lark; it is expected to have the tables ready for operation in 60 days. The company has been experimenting with this make of tables for five months past, and it is reported that the improved saving will more than pay for the cost of installation within a short time. There have been a few of these tables in use in Bingham, at the Bingham-New Haven mill, but the Ohio order will be the first extensive installation in Utah.

SUMMIT COUNTY

Silver King Coalition—The strike of the mill men at this property has been settled by allowing 8-hr. instead of 10-hr. shifts. Three shifts are now operating. An increased output will be maintained from now on.

Virginia—Conditions at the California mine, which is being worked under lease by this company are reported to be improved. A 30-in. vein of shipping ore has been opened in two places about 50 ft. apart, and 100 tons of ore is broken, awaiting the drying up of the roads from the mine to the railroad for shipment. About two tons a day are being produced from development by a small working force. The new ore was opened in a crosscut 65 ft. above the main tunnel.

Snake Creek Tunnel—Work during March encountered a soft black lime, which brought considerable water and swelling ground making timbering necessary. On March 2 the face was 2924 ft. in, and an April 2 the distance was 3065 ft.; permanent ties and rails are down for 2830 ft., and the ventilation pipe is placed for 2805 ft. Early in April the ground improved, and better progress is likely. There has been some talk of suspending operations on the tunnel on account of lack of interest and coöperation of property owners along its route.

Southern Tier—Austin Kelly and associates have taken a lease on this property, also called the Hoyt mine, in Snake Creek cañon near Heber.

West Virginia

J. B. B. Coal Company—This company has been organized and has taken over the mines in the Pocahontas district, heretofore operated by Jewett, Bigelow & Brooks, of Detroit. The following are officers: H. M. Jewett, Detroit, president; Robert Grant, Boston, treasurer; J. W. Bigelow, Twin Branch, W. Va., general manager. The mines were consolidated and a new company formed on March 1, and the New England Coal and Coke Company, of Boston, purchased an interest April 1, and will have charge of the transportation and sale of the coal.

FAYETTE COUNTY

Four States Coal and Coke Company—This new concern took over the property of several coal companies, and will increase its output in the near future.

Cleveland Coal Corporation—Plans have been approved for a $500,000 electric plant, a $100,000 water plant and other equipment for the plant in the New River district.

Kelly's Creek Colliery Company—This company, at Ward, will develop 50,000 acres land for a daily output of 1800 tons. The manager is J. W. Dawson.

KANAWHA COUNTY

Big River Coal, Oil and Gas Company—This company, of Charleston, of which E. F. Brown is president, will develop 25,000 acres of coal land and has begun preliminary work.

West Virginia Coal Land Company—This new company, headed by H. B. Smith, of Charleston, and a number of Eastern capitalists, has purchased 27,000 acres of coal and timber lands, owned by the Gallego Land Company, situated on Cabin and Paint creeks, for $1,350,000. The new purchaser is selling or leasing portions of the tract for immediate development and has already sold 2500 acres to the New Eagle Collieries Company.

LOGAN COUNTY

P. J. Riley and Dr. J. E. Cox, have organized the Manbar Coal Company, to develop coal acreage about nine miles above Logan, on the new extension of the Chesapeake & Ohio. Work has been started recently to develop a 700-ton mine. The new Rocky Creek Coal Company, recently incorporated by F. C. Murlitz and William Getz, of Cleveland, with $300,000 capital, will also develop coal lands in this country.

Canada

British Columbia

Nugget—Vancouver men having purchased 142,000 shares of treasury stock at $1, further development at depth will be undertaken, and erection of a 20-stamp mill arranged for.

Van-Roi—The first month's run of the new mill has resulted in production of 350 tons of silver-lead and silver-zinc concentrates.

Granby—Two of the eight blast furnaces have been blown out, owing to short supply of coke, consequent on labor troubles at coal mines in Crow's Nest Pass district.

Mother Lode—Registration of the Mother Lode Sheep Creek Mining Company has been gazetted in British Columbia. Authorized capital is $1,250,000; head office is in Portland, Maine. The company has a gold property in Sheep creek camp, Nelson mining division.

Slocan Star—Although snow is still deep in the gulches in Slocan, the season's mining has been commenced at the Slocan Star.

Le Roi—A little work is still being done and ore being shipped at a profit. Shipments during four months of 1911 aggregated in excess of 4000 tons of ore.

Hobson's Hydraulic—Preparations are being made for a long season's run on this placer-gold property, near Quesnel forks. Plenty of water is available and the gravel yields profitably.

British Columbia Copper—This company has bonded the McKinley copper-gold group, in Franklin camp, about 60 miles from Greenwood.

Tyee—A number of important mining groups, associated in mining development and finance business in London, have recently made arrangements to participate in this company's business.

Portland Canal—Ore of higher grade than that previously mined has been entered by No. 2 adit on the Portland Canal company's property. For 40 ft. the drift has been in ore varying from 2 to 6 ft. in width, and averaging about $20 in gold, silver and lead, as against $12 in the past. No. 3 adit is entering the downward continuation of the same oreshoot.

Ontario—Cobalt District

Brydge Lease—Work is to be resumed on this Peterson Lake property.

Lawson—On this La Rose property the main shaft will be continued to 300 ft. Results on the 200-ft. level were satisfactory.

Cobalt Central—This property, which has been in liquidation for some time, will be sold at auction May 18.

Buffalo—The mill report of this Cobalt company for March shows a general increase. There were treated 3913 tons, having an average assay of 44 oz. per ton, from which 149,931 oz. of silver were recovered. Milling expenses were $6549.

Ontario—Porcupine

Dome—Work is being rapidly pushed on the construction of the 40-stamp mill. Concrete work for the foundations has been started.

Vipond—On this mine of the Porcupine Gold Mines Company, a Nissen stamp mill is working night and day. The ore which is being run through this mill averages considerably higher than any ore which has been run through a mill in the Porcupine camp.

Brydge—This property on the North boundary of Deloro township, adjoining the Preston claim of the Preston-East Domes Mines Company, has been purchased by Proctor Smith. It is reported that Mr. Smith has bought this claim in conjunction with some others for some important English operators. A number of promising orebodies have been uncovered and some spectacular gold finds have been made.

Hollinger—A crosscut at the 100-ft. level in the main workings has cut the No. 3 vein on the Hollinger property. The vein where opened up is 14 ft. wide and it is reported that it assays $11 per ton in gold. In the face of the drift on the 200-ft. level on the main vein the orebody is 20 ft. wide and carries free gold.

Davidson—The Davidson Gold Mines Company has been incorporated to take over the two Davidson claims in the Northern part of Tisdale township. These properties were staked by Willian Davidson in the fall of 1909 and the first gold discovery in Tisdale township was made on one of these properties. It is reported that a syndicate of New York, Philadelphia and Boston brokers are underwriting the first issue of this stock. The company will be capitalized at $2,000,000, or 400,000 shares, $5 at par.

Fogg-Woodhouse—These locations adjoining the Preston-East Dome have been sold to a Boston syndicate for $200,000.

Porcupine Reserve Mines, Ltd.—A company has been organized under this title capitalized at $2,000,000, and has purchased the Burke and Elliot claims. Work will be begun in a few days with a force of 20 men.

American Gold Fields—On the property of this company adjoining the West Dome two new veins have been opened. The main vein has been found to be about 40 ft. wide. On the other property adjoining the Porcupine Lake company's holding six veins have been opened up, three of which show native gold.

Porcupine Imperial—A new vein, that shows gold, has been discovered on this property.

Jupiter—A new vein 12 ft. wide has been found on this Porcupine property. It is stated to be one of the richest yet found in the entire district.

Mexico

Chihuahua

El Rayo—This Mines Company of America property, near Santa Barbara, recently moved 300,000 pesos worth of bullion held in store owing to the revolutionary disturbances. The product was transferred 12 miles to the railroad through rebel country and then shipped to Torreon.

Sonora

Creston de Cobre—Work on this property, 35 miles west of Hermosillo, owned by the Mexico Mining, Refining and Exploration Company, W. T. Calderwood, of Los Angeles, Cal., president, is proceeding. A concentrator has been installed, and the company expects to make regular shipments.

Manhattan Exploration Company—M. S. MacCarthy is making concentration tests of the ore from the Meseta and Promontorios mines of the company and will shortly come to the United States to conclude the investigation and to have electrostatic and other tests made. The company's office is at Alamos.

Tepic

Mescalitas-Purisisima—This property in the Amatlan de Cañas district is owned by the Pan-American Investment Company, represented by Walter Foster and Em Browder.

South America

Chile

Braden—This company will increase its capital stock from $12,000,000 to $14,000,000. The $2,000,000 new stock will be used to convert a new issue of $2,000,000 three-year 7 per cent. convertible bonds. Last October $2,000,000 second mortgage 7 per cent. 5-year convertible bonds were authorized, of which $1,000,000 has since been issued, leaving $1,000,000 in the treasury. In addition to these two issues there was a former mortgage against $4,000,000 6 per cent. 10-year convertible bonds. The new bonds will be used to pay for completion of the reduction works and power plant, as well as to carry on development work and provide working capital. President Sewall says that there are 12,000,000 tons of 2.70 per cent. ore in the Fortuna mine. Fortuna tunnel No. 4 has not yet reached the main orebody but should do so at about 400 ft. below No. 3½. General Manager Yeatman will remain at the property until June 1, when the first unit of the concentrator should be put in operation. Mr. Yeatman estimates that when completed the concentrator and reduction works should produce annually 36,000,000 lb. of copper at a cost of less than 7½c. a pound.

The Markets

Coal Trade Review

New York, May 10—The coal trade in the East shows a sharp contrast between the unusual activity in anthracite and the slowness of the bituminous-coal market. Anthracite shipments have been heavy and sales large; while bituminous coal drags and sales are slow, with many mines working only half time.

In the West trade has been steadier, but not large. Steam-coal demand is not active, and buyers want low prices. Sales are being made at a low point, and it seems impossible to advance prices in view of the fact that producing capacity is much greater than consumption. Operators are complaining that they are forced to run on slow time, or else part with their coal at prices which cannot possibly pay them.

Coal Traffic Notes

Shipments reported by companies in the Southwestern Interstate Coal Operators' Association in January, short tons:

	1910	1911	Changes
Missouri	316,399	248,159	D. 68,240
Kansas	610,298	462,624	D. 147,674
Arkansas	281,149	143,445	D. 137,704
Oklahoma	333,696	251,411	D. 82,285
Total	1,541,542	1,105,639	D. 435,903

The total decrease reported this year is 28.3 per cent.

Coal and coke tonnage of Virginian railway, nine months of fiscal year from July 1 to March 31, short tons:

	Commercial	Company	Total
Coal	1,539,587	134,211	1,673,798
Coke	10,538	.....	10,538
Total	1,550,125	134,211	1,684,336
Total, 1909-10	707,585	.....	707,585

Coke is reported separately only for part of the current year. Company coal was not reported last year.

Anthracite shipments in April are reported at 5,804,915 long tons, or 191,979 tons less than March. For the four months ended April 30, the shipments were, in long tons:

	1910	1911	Changes
Reading	4,362,204	4,312,037	D. 50,167
Lehigh Valley	3,781,812	4,057,420	I. 275,608
N. J. Central	2,746,862	2,951,480	I. 204,618
Lackawanna	3,189,103	3,043,972	D. 145,131
Del. & Hudson	2,071,093	2,424,001	I. 352,908
Pennsylvania	2,156,567	2,265,800	I. 109,233
Erie	2,515,088	2,846,562	I. 331,474
N. Y., Ont. & West.	914,235	875,602	D. 38,633
Total	21,736,964	22,776,874	I. 1,039,910

The total increase was 4.8 per cent. Three lines—the Philadelphia & Reading, the Delaware, Lackawanna & Western and the New York, Ontario & Western—show decreases; the others gained over last year.

Coal passing through Sault Ste. Marie canals in April: Anthracite, 52,943; bituminous, 286,468; total, 339,411 short tons.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal tonnage originating on Southern railway, two months ended Feb. 28, was: Tennessee district, 207,097; Alabama district, 457,504; total, 664,601 short tons, a decrease of 55,755 tons from last year.

Coal receipts at Boston, four months ended April 30, reported by Chamber of Commerce, in long tons:

	1910	1911	Changes
Anthracite	557,936	607,901	I. 49,965
Bituminous	1,349,295	1,333,784	D. 15,511
Total domestic	1,907,231	1,941,685	I. 34,454
Foreign	100,311	83,130	D. 17,181
Total	2,007,542	2,024,815	I. 17,273

The foreign coal is almost all from Nova Scotia mines.

New York

Anthracite

May 10—Business has continued active, deliveries being on a large scale. April shipments from the collieries were heavy and, apparently have been readily absorbed. Domestic sizes are in demand by dealers locally and for coastwise shipment. Steam sizes have also been moved freely.

Schedule prices for May on domestic sizes are $4.35 for lump, $4.60 for egg and stove and $4.85 for chestnut, all f.o.b. New York harbor. On steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.35@2.80; No. 2 buckwheat or rice, $1.80@2.30; barley, $1.40@1.75; all according to quality, f.o.b. New York harbor. Some individual pea and buckwheat have been offered at $2.90 and $2.25, but only in small lots.

Bituminous

The seaboard soft-coal trade still drags and the promised spring revival does not materialize. Contract making is slow; large consumers have coal in stock yet and are in no hurry to buy more. Coastwise movement is only moderate, and harbor trade is limited to hunting for bargains. There is, however, little or no demurrage coal to pick up, as the mines are generally limiting shipments to tide.

Prices are weak, but show no quotable change. Steam coals can be had at $2.30@2.40 for lower grades, with bet-better coals up to $2.75@2.85. A good Miller vein coal can be had around $2.50 @2.60, f.o.b. New York harbor. Gas coals can be had at $1.05 for ¾-in., $1 for run-of-mine and 75@80c. for slack, all at mines. Some off-color New River has been offered as low as $2.25, f.o.b. docks.

Coastwise trade is moderate and freights have weakened. Vessels can be had at 65@75c. from Philadelphia to Boston or Portland. From New York going rates are 50@65c. to points around Cape Cod; 25@35c. to Providence and the Sound. Some cargoes are reported taken at 60@75c. from Hampton Roads to Boston.

Birmingham

May 8—There is some prospect for better conditions in the coal trade in Alabama. There is some demand for coke. The production has not been decreased recently. It is announced that since the successful operation of the new byproduct coke ovens of the Woodward Iron Company, at Woodward, a new company has come into the district to use some of the byproducts of this plant. The new concern will be established at North Birmingham.

It is announced that the Tennessee company will shortly begin the sinking of another shaft in the coalfields, a short distance from Ensley.

Chicago

May 9—The coal market continues quiet but generally satisfactory to wholesalers, sales being large for the time of the year and the supply not over great on any line. Supplies are fairly well regulated to the needs of the market except in the case of smokeless, which should be sent with caution. Prices maintain a firm tone, and are not substantially changed from last week's quotations. The greatest demand in steam coals is for screenings; the least for lump. Domestic coals have been in good demand for the last week because of the cool weather over Chicago territory; the beginning of this week, however, sees a cessation of the demand, owing to a warm wave. Contract making contines large, at rather low prices, and the volume of sales by contract probably will exceed any previous record. The May advance of prices has checked the buying of anthracite, which still remains good for the first week in May.

Cleveland

May 8—The market is extremely dull all around. Steam-coal demand does not improve and domestic trade is dead for

the present. Lake trade opens so slowly that it is uncertain when the surplus on tracks will be reduced.

Prices are unchanged. Next week the reduced spring schedule will be announced. Coal is in abundant supply for all kinds except Pocahontas.

Indianapolis

May 8—A notable feature of the coal business for the last week has been the inclination among large coal users to delay making contracts, although they admit that the prices offered by the operators are highly satisfactory. The operators say that something aside from the price of coal is causing consumers to delay. The Indiana mines are producing a limited amount of coal. Some mines are working nearly the whole week, others only a few days each week. The cool weather has kept up a fair demand for domestic coal. The demand for steam coal is increasing gradually, but is not equal to this time last year.

Pittsburg

May 9—Coal mines are running at a slower gait, on account of congestion in the Lake coal trade, while local demand is poor. Prices are moderately well maintained: Nut, $1.05@1.15; mine-run, $1.10@1.15; ¾-in., $1.20@1.25; 1¼-in., $1.30@1.35; slack, 75c. per ton at mine.

Connellsville Coke—An unusually large volume of business has been done in the past 10 days, considering the prevailing dullness. Sales include 2500 tons of a special brand of furnace coke at $1.65, and three lots of 5000 tons each, at $1.60, $1.55 and $1.50, the $1.55 coke having been sold in the East while the other two lots were sold in the Central West. All these lots were for deliveries spread over the current month, and it is reported that another lot, running about 5000 tons, has been sold to a Valley steel interest at $1.50 for the current month. There is a little figuring on contracts for second half, and one such may possibly be closed within a few days. As a rule consumers are not anxious to buy ahead and producers are somewhat chary of selling in the present unpromising market. We quote: Prompt furnace, $1.50@1.55; contracts for second half, $1.75@1.85; prompt foundry, $1.90@2; contract foundry, $2@2.25, at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ending April 29 at 300,540 tons, a decrease of 12,000 tons, and shipments at 3287 cars to Pittsburg, 5129 cars to points west and 798 cars to points east, a total of 9214 cars.

St. Louis

May 8—The market has been extremely dull this week and at current prices mine-run coal has been netting the operators 1 or 2c. less per ton than heretofore. All of the operators who are running now are losing at least 5c. per ton on their entire output. However, they seem to prefer to keep on running rather than to close down.

Dealers report a fair volume of business though, of course, the domestic business for this reason is about over. The storing of anthracite has begun, which will, of course, keep dealers fairly busy for the next month or two. The industrial situation is far from satisfactory and business seem to be way below expectations. Plants in St. Louis and vicinity are running only about two-thirds time. However, it seems that the situation locally is more satisfactory than it is in Chicago and other parts of the country, as a good deal of coal that would logically go to Chicago is being shipped to St. Louis. This makes the St. Louis market even worse than it should be. Screenings are being absorbed freely and prices are somewhat better than last week, though not up to the level of last month. Most of the coal that is coming to this market is Standard. A good quantity of Carterville screenings are being used in St. Louis, though practically none of the larger sizes. Nut is in better demand again and is bringing the best price of any size on the market.

Anthracite—Coal is moving fairly well, and while a large tonnage was sold in April, the mines have been somewhat backward in shipments. In fact not over 30 per cent. of the coal ordered has come forward yet.

Calgary, Alberta

The miners concerned in the proceedings of the Board of Conciliation and Investigation appointed to inquire into the various matters in dispute between the Western Coal Operators' Association and District 18, United Mine Workers of America, the latter representing the men employed in the coal mines in southern Alberta and the Crow's Nest district of British Columbia, have demanded that the meetings of the board be open to press and public. Heretofore only representatives of the two parties to disputes have been permitted to be present at such inquiries. The miners protest against this lack of publicity and state they will not give evidence under conditions of secresy.

FOREIGN·COAL·TRADE

French Foreign Trade—Imports and exports of fuel in France, year ended Dec. 31, 1910, metric tons:

	Imports.	Exports.	Excess.
Coal	14,907,340	1,278,711	Imp.13,628,629
Coke	2,273,490	168,975	Imp. 2,104,515
Briquets	974,530	132,391	Imp. 842,139
Total	18,155,360	1,580,077	Imp.16,575,283
Total, 1909	18,397,712	1,493,308	Imp.16,904,404

Decrease in imports, 242,352 tons, or 1.3 per cent.; increase in exports 86,769 tons, or 5.8 per cent. Exports in 1910 included 123,547 tons of coal and 62,690 tons briquets furnished to steamships in foreign trade.

Russian Coal—Shipments from the mines of the Donetz basin, the chief coal-producing district in Russia, in 1910 were: Anthracite, 2,103,000; bituminous coal, 9,037,000; coke, 1,400,000; briquets, 112,000; total, 13,652,000 metric tons, an increase of 302,000 tons, or 2.3 per cent., over the previous year.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on April 28, as follows: Best Welsh steam coal, $4.14; seconds, $3.90; thirds, $3.78; dry coals, $3.84; best Monmouthshire, $3.72; seconds, $3.54; best small steam coal, $2.58; seconds, $2.28. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, May 10—The consensus of the recent steel dinner seems to have rallied the large interests to maintain prices of finished steel. Whether this can be done successfully in the present condition of the market is a question. The fabricating companies in the East continue to take large contracts at figures which certainly involve reductions in structural steel. Agricultural-implement makers are holding back their yearly contracts, looking for a reduction. Sheets, wire and wire products are being shaded by the smaller independents—and by some of the larger ones too, it is reported. In a word there are indications that price reductions must come soon, and be recognized by all.

Outside of structural steel, new business comes slowly in finished material. This is to be expected under the conditions outlined above. The Chicago, Milwaukee & St. Paul is said to have placed orders for 40,000 tons of rails.

Pig iron has been a little more active. More sales are reported, with a tendency to increase the size of orders. Shading in prices is reported here and there. In seaboard territory Southern furnaces are making a hard push for business. The Birmingham furnaces are holding to $11 for No. 2 foundry; but some good orders are reported placed with Tennessee makers at $10.75 and even $10.50. Virginia furnaces are also making concessions to get good orders. Pipe makers have been buying extensively of lower grades.

The rules committee of the House of Representatives has reported a resolution directing an investigation of the iron and steel industry. This resolution will undoubtedly be adopted by the House within a few days; it provides for a committee of nine men to be elected by the House and given full power to issue subpœnas, send for persons and papers, and do everything incident to a congres-

sional investigation of the usual type. Included in this inquiry, it is understood, will be a study of the extent of control exercised by steel makers over iron-ore supplies, and the degree to which the iron- and steel-making business has been monopolized. The Steel Corporation reports its unfilled orders on books May 1 at 2,218,704 tons; a decrease of 181,839 tons from the previous month.

Pig Iron Production—The reports from the blast furnaces, as collected and published by the *Iron Age*, show that on May 1 there were 212 coke and anthracite furnaces in blast, having an aggregate daily capacity of 64,450 tons; a decrease of 6300 tons as compared with April 1. Making allowance for the charcoal furnaces, the production of pig iron in April is estimated at 2,093,500 tons; for the four months ended April 30 it was 7,919,700 tons. Of this total, 5,266,300 tons were made by furnaces owned and operated by steel companies.

Baltimore

May 8—Imports for the week included 431 tons ferromanganese ore from Liverpool; 211 casks manganese ore from Rotterdam; 8013 tons iron pyrites from Huelva, Spain; 30,400 tons iron from Cuba.

Birmingham

May 8—Plans of further curtailment in the Southern pig-iron make are being put into execution, the intent being to regulate the production in accordance with the market. The demand is still slow and for small lots. Consumers are holding off, confident that at any time they care to they can buy iron at low prices. A few sales of low-grade iron have been made recently and delivery is going on, but the total business being booked is not of any consequence. It is believed that with further curtailment in this section of the country some of the accumulated stocks of iron can be worked off. There will be no resumption at blast furnaces until the market improves. A few orders are coming from cast-iron pipe makers, but in the main this business is for low-grade iron, No. 4 foundry. Two furnaces have been shut down again, and if there is no improvement in the market during May a couple of other iron makers will cease to operate.

In the steel line the plant of the Southern Iron and Steel Company, at Gadsden, and the rolling mills of Tennessee Coal, Iron and Railroad Company, at Bessemer, producing fabricated steel, are doing well yet.

The cast-iron pipe trade in the Southern territory is quite active with other business in sight. The scrap-iron business is dull, as are the machinery and foundry trades.

Chicago

May 9—Sales of pig iron continue light, the market being one of small lots sold for piecing out the needs of founders in the second and third quarter, chiefly. Few contracts that run over 1000 tons are made, the tendency of the melters being to buy lightly and await developments. Local production has been lessened and Northern is somewhat firmer in consequence, though far from strong, at $15 for No. 2. Southern holds to $11, Birmingham, or $15.35, Chicago, though a large sale might be made at slightly less, of either. Some important interests are making inquiries for second-half tonnage and the general requirements of that period, yet to be contracted for, are probably large.

Sales of iron and steel products are somewhat larger, and the market seems to be improving, though far from brisk, with structural material showing most activity. The coke market is very dull.

Cleveland

May 8—The settlement on 60c. from the head of the Lakes as ore freight for the season has been practically accomplished by the making of several contracts. Shipments are slow in starting.

Pig Iron—At least one round sale of pig iron is noted at a slight shading from previous quotations. For the most part, however, prices are held at previous points. Quotations, Cleveland delivery, are $15.90 for bessemer, $14.25@14.50 for No. 2 foundry, $13.75@14 for forge, and $17.50@18 for Lake Superior charcoal iron.

Finished Material—Some contracts for structural steel make up most of the market. Prices of bars and sheets are inclined to be irregular.

Philadelphia

May 10—The week in eastern Pennsylvania has been unusually dull, the only reported business being the sale of a few lots of a special brand for early delivery. Furnace owners are working off stocks as fast as possible and a further curtailment is said to be contemplated. The low prices prevailing do not stimulate inquiry and even the larger interests are postponing buying a little longer. The only interesting inquiries are for malleable and they are only for small lots. Forge iron is perhaps duller than any other line because of the prospects of a dull summer. No. 2 X foundry would sell more freely were it not for some recently shaded rates on Southern which will probably secure what little business is going. The entire crude-iron market is in an exceptionally sluggish condition and stocks among consumers are generally lower than it is usual to allow them to go. Southern No. 2 foundry is offered at $15 and gray forge at $14.25. Northern forge is readily picked up at $14.50 per ton.

Steel Billets—Forging billets have again been slightly shaded without drawing out large orders.

Bars—Less bar iron is being made than a month ago and some further curtailment seems probable.

Sheets—Heavy sheets are profiting by the increasing activity in building and the week's business constitute a bright spot in the otherwise dull and disheartening situation.

Pipes and Tubes—Tubes are merely holding their own at recent discounts. Merchant pipe has dropped off; the cast pipe foundries are doing big business.

Plates—A large amount of business is on the point of being emptied into the plate mills from New England, New York and elsewhere. The securing of this business will help to tide the mills over a dull period. The volume of small orders shows scarcely any falling off.

Structural Material—The large amount of building now projected and under way promises an active early summer demand for shapes, largely for delivery along the North Atlantic coast.

Scrap—The scrap market has fallen back and very little material is being purchased by the mills or machine shops. The Pennsylvania Railroad will soon dispose of a large amount of scrap.

Pittsburg

May 9—Demand for finished steel products has been showing slight ups and downs, with no decided trend in either direction in the past fortnight. One large steel interest reports that its last week's bookings were larger than either of the two preceding weeks, while its bookings Monday of this week were very large for a single day. Other interests find decreases in bookings in some cases, and increases in others.

Pig-iron production continues to decrease. The country is producing pig iron at a trifle under 70 per cent. of the total capacity. Steel production, however, is at a lower rate, between 50 and 60 per cent. of capacity.

Prices are being firmly held by the large steel interests, while the cutting by small interests is perhaps a little more pronounced. There is no prospect of any general reductions in prices by the large interests, but in responsible quarters the belief is entertained that the price-maintenance policy cannot stand much more pressure and that in the event of orders continuing light for a month or two longer, with cutting by the smaller interests, a general break will occur. There are some, too, who suspect that the large interests would not be altogether averse to a break, if there were reason to expect that it would start a general buying movement.

Pig Iron—The United Steel Company, Canton, O., is understood to have bought

the 3000 tons of basic iron recently inquired for, for third-quarter delivery, at a trifle less than $14, delivered, and it is believed that Cleveland took the business. The Cleveland furnaces will make lower prices in competitive districts than they will in their own local market. The American Steel Foundries is inquiring for about 5000 tons of basic, for third-quarter delivery to its Alliance and other plants, but the business is not coming to a head rapidly. Foundry iron is extremely quiet. The market is quotable as follows, Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $15; basic, $13.50@13.75; No. 2 foundry and malleable, $13.75@14 per ton.

Ferromanganese—The market continues quiet, with prices for prompt and forward at about $36.50, Baltimore.

Steel—The leading steel mills are adhering to regular quotations, $23 on billets and $24 on sheet bars, Pittsburg or Youngstown, with $29 on wirerods, Pittsburg, but there is practically no business being done. There are rumors that open-hearth billets and sheet bars can be bought at 50c. or $1 under the regular quotations, but there is no business to test the accuracy of the rumors. Consumers are fully covered by their regular contracts, and they are curtailing shipments on these, rather than purchasing additional lots.

Sheets—The market continues very quiet, with prices moderately well held at the former level of 2.20c. for black, 3.20c. for galvanized, 1.65c. for blue annealed, $1.55 for painted corrugated and $2.75 for galvanized corrugated.

St. Louis

May 8—The pig-iron market is very dull. All of the business is small and there seems no improvement in sight. A few small inquiries for third-quarter delivery have been received. The market remains unchanged at $11, Birmingham, or $14.75, St. Louis. There seems to be no question that this price would be shaded for any considerable tonnage.

FOREIGN IRON TRADE

German Iron Production—The German Iron and Steel Union reports the production of pig iron in the German Empire in March at 1,322,114 tons, an increase of 143,005 tons over February. For the three months ended March 31, the make of pig iron was, in metric tons:

	1910	1911	Changes	
Foundry iron	675,747	773,850	I.	98,103
Forge iron.....	167,551	147,685	D.	19,866
Steel pig	314,527	428,202	I.	113,675
Bessemer pig.....	120,929	87,781	D.	33,148
Thomas(basic)pig	2,240,355	2,384,390	I.	144,035
Total.....	3,519,109	3,821,908	I.	302,799

The total increase was 8.6 per cent. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

METAL MARKETS

New York, May 10—The metal markets remain rather quiet, with no material changes.

MONTHLY INDEX NUMBERS

Month	1910	1911	Month	1910	1911
January....	127	110	July..:.....	112	.....
February ..	124	115	August.....	113	.....
March.....	118	112	September.	114	.....
April.....	118	114	October	111	.....
May	113	.....	November .	117	.....
June.....	107	.....	December..	115	.....

Year 1909, 115; 1910, 115.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Mar. 1911..	$ 505,615	$ 4,119,063	Imp.$ 3,613,448
" 1910..	1,815,815	4,373,885	Imp. 2,558,070
Year 1911..	1 854,024	19,465,737	Imp. 17,611,713
" 1910..	10,916,081	9,568,358	Exp. 1,347,723
Silver:			
Mar. 1911..	5,896,795	3,197,409	Exp. 2,699,386
" 1910..	4,552,624	3,994,456	" 558,168
Year 1911..	16,001,042	10,746,781	" 5,254,261
" 1910..	13,639,547	11,398,139	" 2,241,408

Exports from the port of New York, week ended May 6: Gold, $34,475; silver, $902,340, chiefly to London and Paris. Imports: Gold. $226,780; silver, $313,211, from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London continued at the usual level, 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. Supplies were again divided between India and the Bank of England.

The New York Assay Office reports sales of gold bars for use in the arts at $2,085,458 in April and $8,902,578 in the four months ended April 30; an increase of $287,064 over last year.

Iridium—Prices are firm and unchanged at $62 per oz. for pure metal.

Platinum—The market is very strong, and prices have advanced, while a further increase is expected. The quotation this week is $42@42.50 per oz. for refined platinum and $44.50@45 for hard metal. The foreign market is reported very strong.

Our Russian correspondent reports, under date of April 27, that the market and prices are unchanged. Rumors are afloat that the recent regulation for the platinum industry—the prohibition to export crude platinum, etc.—will be rejected by the State Duma. The metal it quoted in St. Petersburg at 35,000 rubles per pood; at Ekaterinburg, 9.30 rubles per zolotnik—$34.30 and $34.97 per oz., respectively—for crude metal, 83 per cent. platinum.

Silver—The market has no new feature. Prices remain quite steady, sustained chiefly by Indian bazaar buying.

SILVER AND STERLING EXCHANGE

May	4	5	6	8	9	10
New York....	53	53⅛	53⅛	53⅛	53⅛	53⅛
London.....	24 7/16	24 7/16	24 7/16	24 9/16	24 7/16	24½
Sterling Ex..	4.8645	4.8645	4.8640	4.8630	4.8635	4.8640

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to April 27, as reported by Messrs. Pixley & Abell:

	1910	1911	Changes	
India.....	£2,177,600	£3,123,700	I.	£ 946,100
China.....	1,113,500	802,800	D.	310,700
Total.....	£3,291,100	£3,926,500	I.	£635,400

India Council bills in London brought an average of 16.06d. per rupee for the week.

The United States Mint has recently bought 800,000 oz. silver for subsidiary coinage; 200,000 oz. on March 15 and 25, April 7 and 15, each.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
4	12⅛ @12⅜	11.95 @12.00	41¾	4.37½ @4.40	4.22½ @4.25	5 35 @5.37½	5 20 @5 22½
5	12⅛ @12⅜	11.95 @12.00	41⅞	4.37½ @4.40	4.22½ @4.25	5.35 @5.37½	5.20 @5.22½
6	12⅛ @12⅜	11.95 @12.00	41⅞	4.37½ @4.40	4.22½ @4.25	5.35 @5.37½	5.20 @5.22½
8	12⅛ @12⅜	11.90 @12.00	42¼	4 37½ @4.40	4.22½ @4.25	5.35 @5.37½	5.20 @5.22½
9	12⅛ @12⅜	11 90 @12.00	42	4 37½ @4.40	4.22½ @4.25	5 35 @5.37½	5.20 @5.22½
10	12⅛ @12⅜	11.90 @12.00	41	4.37½ @4.40	4 22½ @4 25	5 35 @5 37½	5.20 @5 22½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
4	54	54⅝	58	191⅛	189½	12⅞	24¼
5	53⅞	54½	57¾	193	189½	12⅞	24¼
6	.....	.....	.....	.....	.....	.....	.....
8	53 13/16	54 7/16	57¾	194¼	190¼	12 13/16	24¼
9	53 13/16	54 7/16	57¾	193	189	12 13/16	24⅜
10	53¾	54 5/16	57¾	193⅛	189¾	13	24⅜

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23=5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been very quiet. For Lake the quotations are scarcely more than nominal, so little business having been done. It is reported that the Calumet & Hecla has reduced its asking price to 12⅜c., while good ordinary brands of Lake copper have been offered at 12¼c. In electrolytic some small sales have been made, both for foreign and domestic shipment, at 12⅛@12.20 delivered, usual terms. The business was mainly consummated in Europe and was taken by second hands. The demand both here and abroad is small and is being freely met and all of the principal sellers have shaded last prices. The report of the Copper Producers' Association was not favorably received; nor was the quarterly report of the Utah Copper Company, which was regarded as implying the probability of a larger production by it in the near future. At the close Lake copper is quoted at 12⅛@12⅜c.; and electrolytic copper in cakes, wirebars and ingots at 11.90@12c. Casting copper is quoted nominally at 11¾@11⅞ cents.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill.

Transactions in London in standard copper have been of small volume, and the market has been quiet and weakish, closing at £53 15s. for spot, and £54 6s. 3d. for three months.

Copper exports from New York for the week were 6379 long tons. Our special correspondent reports no exports from Baltimore for the week.

The Miami Copper Company is going to sell its product from its own office. This will eventually amount to about 40,000,000 lb. per year.

The depletion of copper stocks in the hands of manufacturers has been referred to frequently. A certain manufacturer came into New York recently to hurry up deliveries, saying that if he could not get some copper inside of a week he would have to close his plant. Such close sailing in the matter of everyday working supply on the part of an important manufacturer is astonishing and we doubt if the generality has drawn things so fine; but certainly there will be a great rush to buy whenever the market definitely begins to trend upward.

Tin—The market throughout the week, both in London and here, presented an exceptionally quiet appearance. The unfavorable reports as to consumption and the cessation of orders from this country no doubt put a damper on London speculation for the advance, and therefore the policy of the Syndicate seems to be to keep the market as quiet as possible for the present. In this market, there is hardly any business between dealers, and consumers are still able to provide for their wants at from ¼@½c. below the import basis. The market in London closes firm at £193 2s. 6d. for spot, and £188 15s. for three months, while May tin is quoted nominally at about 42c. in New York.

The official report gives the production of Banka tin in 1910 at 15,890 long tons; Billiton, 4229; Singkep, 418; total for the Dutch East Indies, 20,537 tons, an increase of 3682 tons over the previous year.

Lead—The market is dull. There is a fair business doing from day to day, for which slightly lower prices have been accepted. The market closes at 4.22½@4.25c., St. Louis, and 4.37½@4.40c., New York.

The London market is somewhat better, Spanish lead being quoted at £13, and English at £13 2s. 6d. per ton.

Spelter—The market has been dull and sagging throughout the week, liberal offerings at 5.22½, St. Louis, having been rejected. The business actually negotiated was at a little below that figure, some tonnage having been sold, while manufacturers were reported as being willing to take larger quantities at a little under 5.20c. The price for spelter in this country is hovering only a little above the export point, but it is not believed in the trade that any exports will be made, inasmuch as the available supply of spelter is really needed in this country and any immediate prospect of exportation would doubtless stimulate buying here. At the close the metal is quoted at 5.20@5.22½c., St. Louis and 5.35@5.37½c., New York.

The London market for good ordinaries is slightly higher at £24 7s. 6d., with £24 12s. 6d. for specials.

Base price of zinc sheets $7.25 per 100 lb., f.o.b. La Salle-Peru, Ind., less 8 per cent. discount.

Silesian Spelter Market—Paul Speier writes from Breslau, Germany, under date of April 29, that the market remains strong, with good demand. Quotations for good ordinary brands are 48.50 marks per 100 kg.—equal to 5.24c. per lb.—f.o.b. works. Special, 49.50 marks. Zinc sheets are in good demand at 56.85@58.85 marks per 100 kg. at works—equal to 6.25c. per lb., average. Zinc dust is quoted at 45 marks per 100 kg.—4.86c. per lb.—f.o.b. Stettin.

Exports and imports of zinc and zinc products in Germany, three months ended March 31, metric tons:

	Imports 1910	Imports 1911	Exports 1910	Exports 1911
Spelter	8,348	12,079	18,277	19,835
Zinc scrap	346	476	1,268	994
Zinc sheets	36	70	4,631	13,759
Zinc pigments	2,006	2,126	7,903	8,647

Imports of zinc ores, 45,265 tons in 1910, and 52,134 in 1911; exports, 12,262 tons in 1910, and 9626 this year.

Other Metals

Aluminum—The market continues dull, with prices unchanged at 20½@21c. per lb. for No. 1 ingots.

Antimony—The market is still dull, with only small sales. Cookson's is held at 9.40@9.60c. per lb. and U. S. at 9c. The outside grades are lower, sales being made at 8@8¼c. for Hungarian and Chinese.

Quicksilver—Spot supplies are still rather scarce. Quotations, however, are unchanged. At New York, sales are made at $46.50, to arrive, per flask of 75 lb. San Francisco, $46 and $43.50 for domestic and export orders, respectively. London price is £9 per flask, with £8 7s. 6d.@£8 10s. quoted by second hands.

Cadmium—The price in Germany has been advanced recently. Current quotations for metal 99½ per cent. pure are 700@750 marks per 100 kg.—equal to 78.27c. per lb., average.

Zinc and Lead Ore Markets

Platteville, Wis., May 6—The base price paid this week for 60 per cent. zinc ore was $39@40. The base price paid for 80 per cent. lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED MAY 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb
Platteville	956,150	.....	306,200
Mineral Point	589,640	.....	.....
Galena	541,200	.....	.....
Cuba City	165,380	.....	601,100
Hazel Green	149,290	57,220	.....
Harker	135,840	57,090	68,500
Highland	116,000	.....	.....
Benton	84,000	.....	.....
Montfort	81,460	.....	.....
Total	2,818,960	114,310	975,800
Year to date	47,398,760	2,863,595	12,343,830

Shipped during week to separating plants, 2,545,510 lb. zinc ore.

Joplin, Mo., May 6—The highest price paid for zinc sulphide ore was $43 per ton, the base ranging from $36 to $40.50 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $19@21 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $36.66. As high as $58 was paid in settlement for lead ore purchases of previous weeks, but the buying price of this week was $55@57. The average price, all grades of lead ore, was $56.46 per ton.

Association matters are held secretly, though there are many rumors current. As the year has expired for which the organization was formed, the contracts with producers are at an end, as none have sought for extension. The secretary's year expires May 10. The executive committee has made several efforts to meet during the week, but so far as can be ascertained no quorum has been present. The total subscription of $17,000 has brought to the members, so it was declared over and over in the public meetings, the knowledge that the best thing producers could do was to sign their ore over for contract sale.

SHIPMENTS, WEEK ENDED MAY 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,575,240	.....	1,000,170	$115,433
Joplin	1,890,340	.....	337,380	47,253
Oronogo	1,075,760	.....	.....	21,995
Galena	791,400	.....	103,990	18,847
Duenweg	440,110	85,780	52,430	10,885
Spring City	92,810	722,490	52,830	10,828
Granby	268,900	448,460	23,760	9,304
Alba-Neck	367,050	.....	47,810	9,070
Miami	48,500	.....	133,190	4,443
Quapaw	121,280	.....	77,130	4,081
Jackson	208,230	.....	.....	3,852
Carl Junction	192,350	.....	.....	3,847
Aurora	119,050	62,970	.....	2,830
Carthage	.....	.....	20,110	542
Badger	20,490	.....	.....	379
Totals	10,211,510	1,319,700	1,848,800	$263,589
18 weeks ..	174,250,200	11,471,200	30,897,110	$4,448,395

Blende val., the week, $196,714; 18 wks., $3,455,046
Calamine, the week, 14,679; 18 wks., 135,273
Lead, the week, 52,196; 18 wks., 858,076

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.77
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	.....	37.51	.....	48.16	.....
June	40.20	.....	37.83	.....	48.80	.....
July	39.63	.....	36.80	.....	48.59	.....
August	40.13	.....	37.32	.....	49.75	.....
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, May 10—The general market has been quiet and rather uninteresting.

Nitrate of Soda—Business is good, and prices a shade higher, 2.12½c. per lb. being named for spot, and 2.10c. for futures.

Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on May 1 as follows, in long tons:

	1910	1911	Changes
Stocks, Jan. 1	14,000	12,790	D. 1,210
Imports, 4 mos	160,680	198,312	I. 37,632
Total	174,680	211,102	I. 36,422
Deliveries, 4 mos	168,155	194,522	I. 26,367
Stocks, May 1	6,525	16,580	I. 10,055
Afloat for U. S.	80,000	80,000	.....

Quantities afloat include all cargoes due to arrive at United States ports by Aug. 15 next.

Chilean advices report that nine-tenths of the nitrate producers have agreed to a renewal of the old Nitrate Association.

Copper Sulphate—Supplies are coming in more freely, putting buyers in a better position. Prices are unchanged, however, at $4.25@4.50 per 100 lb. for carload lots.

Arsenic—The market remains very dull, with few sales. Prices are again off a shade, $1.75 per 100 lb. being asked for white arsenic.

Petroleum

Production and deliveries of petroleum in California, three months ended March 31, are reported as follows, in barrels of 42 gal. each.

	Production	Deliveries
January	6,566,180	5,577,946
February	5,973,206	5,162,223
March	7,089,955	5,087,551
Total	19,629,341	15,827,720
Total, 1910	16,081,485	16,211,161

Total increase in production 3,547,856 bbl., or 22.1 per cent.; decrease in consumption, 383,441 bbl., or 2.4 per cent.

MINING·STOCKS $

New York, May 10—Dullness has continued to rule in the general stock markets. Trading has been on a small scale with only fractional changes in quotations. The market has no apparent tendency and is chiefly a professional one, the public taking little interest.

The Curb market has also been dull, with few changes and only moderate sales. Copper stocks have about held their own, but no gains are recorded. Cobalt stocks were a little more active, but still rather slow. The new Porcupine stocks are not attracting much interest.

Sales at auction in New York, May 3, included four shares Standard Oil Company, $100 par, $676 per share; 10 shares, $10 par, and $50 first-mortgage bond Mexican Homestake Mining Company, $30 for the lot; four shares Oatka Mining Company, $12.75 per share; 25 shares Joseph Dixon Crucible Company, $100 par, $280 per share; 150 shares Peregrina Mining and Milling Company preferred, $100 par, $25 per share, and 100 shares common stock, $10 par, 10c. per share.

Boston, May 9—There is little new to record in the copper share market. Prices in the main have held firm, although there are some exceptions. Calumet & Hecla made a new low today at $465. This is $5 below Feb. 27 last. It will be remembered that in the early part of 1907 the price reached $1000 per share. This weakness was purely local and did not spread to the balance of the list.

Although the Copper Producers' report for April showed an increase of 3,500,000 tons in the visible supply it had no unfavorable bearing on the copper group as a much larger increase had been looked for. The most notable stocks for strength during the week were Lake and Old Dominion. Mohawk and North Butte have been inclined to be reactionary. Mayflower and Michigan among the cheaper issues have been persistently strong.

Copper Range has formally made a proposition to take over the Atlantic mine and has made an offer to exchange

COPPER PRODUCTION REPORTS
Copper contents of blister copper, in pounds

Company	February	March	April
Anaconda	20,900,000	21,900,000	21,500,000
Arizona, Ltd	2,860,000	3,094,000	.....
Balaklala	676,605	866,670	.....
Copper Queen	7,114,278	7,333,629	6,933,422
Calumet & Ariz	1,762,000	1,960,000	.....
Detroit	1,918,365	1,914,710	1,814,740
East Butte	1,065,000	1,120,000	.....
Imperial	.....	.....	.....
Nevada Con	4,992,553	5,932,259	.....
Old Dominion	1,890,000	2,563,000	2,535,000
Shannon	1,166,000	1,322,000	1,258,000
Superior & Pitts	1,808,000	2,540,000	.....
United Verde*	2,800,000	3,000,000	.....
Utah Copper Co	7,329,326	7,260,267	.....
Lake Superior*	17,750,000	20,000,000	.....
Non-rep. mines*	12,600,000	12,525,000	12,125,000
Total production.	86,032,127	93,331,535	.....
Imports, bars, etc.	23,935,222	24,345,814	.....
Total blister	109,967,349	117,677,349	.....
Imp. in ore & matte	5,981,487	6,126,650	.....
Total	115,948,836	123,803,999	.....
Brit. Col. Cos.:			
British Col. Copper	767,470	804,542	.....
Granby	1,633,300	1,988,341	.....
Mexican Cos.:			
Boleo	2,226,560	2,700,880	.....
Cananea	3 906,000	3,542,000	3,644,000
Moctezuma	1,950,475	2,049,150	2,315,292
Exports from:			
Chile	5,488,000	9,408,000	.....
Australia	2,744,000	4,816,000	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
IV, 1910	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599

	Visible Stocks. United States.	Europe.	Total.
V, 1910	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,818
VIII	170,640,678	222,320,000	392,960,677
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	236,629,120	358,649,315
II	142,439,490	236,992,000	379,431,190
III	156,637,770	233,385,600	390,023,370
IV	162,007,934	223,014,400	385,022,334
V	165,555,908	212,284,800	377,840,708

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

its own stock in the proportion of one for each 10 shares of Atlantic. This has had a stimulating effect on Atlantic stock.

Rhode Island Coal has been the Curb feature selling off close to $2. Payments on the recent issue of 10,000 shares of treasury stock were not met and the result was a break in the stock.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev.	May 9	May 31	$0.05
Andes, Cal.	May 2	May 23	0.10
Amer. M. Co., Ida.	May 6	May 27	0.001
Bell, Ida.	Apr. 29	June 6	0.04
Best & Belcher, Nev	May 17	June 6	0.10
Bonanza Mountain, Ida.	Apr. 28	May 27	0.001
Challenge, Cal.	Apr. 26	May 27	0.05
Confidence, Nev.	May 11	May 31	0.20
East Hercules Extens'n, Id.	June 19	July 19	0.001
Ely Consolidated, Nev.	May 2	June 22	0.05
Gold Mt. Champion, Utah	May 20	June 7	0.01
Gould & Curry, Nev.	May 12	June 1	0.10
Mountain Dell, Utah.	May 31	June 16	0.02
North Star, Ida.	May 15	June 15	0.001
Overman, Nev	May 17	June 7	0.05
Potosi, Nev.	May 8	May 31	0.10
Reindeer, Ida.	June 1	July 1	0.005
Seven Troughs, Nev.	May 15	June 2	0.0025
Sierra Nevada, Nev.	May 4	May 25	0.10
Silver Shield, Utah.	May 16	June 3	0.015
Smuggler, Utah.	May 20	June 20	0.005
Swansea Consolidated, Utah	May 15	June 7	0.01
Trans.-Continental, Ida.	May 3	May 27	0.002
Utah-Arizona, Ariz.	May 20	May 31	0.005
Utah Consolidated, Utah.	May 20	June 10	0.01
Yellow Jacket, Nev	May 8	June 8	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53 795	23.843	24.154	24 865
February	51.472	51.534	52 222	23 706	23.794	24 081
March	50.468	51.454	52 745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24 595
May	52.905	53.870		24.343	24.797	
June	52.538	53.462		24.166	24.651	
July	51.043	54.150		23.519	25.034	
August	51.125	52.912		23.588	24.428	
September	51.440	53.295		23.743	24.567	
October	50.923	55.490		23.502	25.596	
November	50.703	55.635		23.351	25.680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57 238	54.035
May	12.550		12.885		56.313	
June	12.404		12.798		55.310	
July	12.215		12.570		54.194	
August	12.490		12.715		55.733	
September	12.379		12 668		55 207	
October	12 553		12.788		56.722	
November	12.742		12 914		57 634	
December	12.581		12 863		56 769	
Year	12.738		13.039		57 054	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41 255	July	32 695	
February	32.920	41 614	August	33.972	
March	32.403	40.157	September	34.982	
April	32.976	42.185	October	36.190	
May	33.125		November	36 547	
June	32.769		December	38.199	
			Av. Year	34.123	

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4 266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315		4.164		12.550	
June	4.343		4.207		12.688	
July	4.404		4.291		12.531	
August	4.400		4.290		12.513	
September	4.400		4.289		12 582	
October	4.400		4.271		13.091	
November	4.442		4.314		13.217	
December	4.500		4.363		13.197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191		5.041		22.100	
June	5.128		4.978		22.094	
July	5.152		5.002		22.406	
August	5.279		5.129		22.800	
September	5.514		5.364		23.165	
October	5.628		5.478		23.900	
November	5.976		5.826		24.083	
December	5 624		5.474		24.019	
Year	5.520		5.370		23.050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$19.90	$15 90	$17.98	$14 40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10		15.94		16.18	
June	16.52		15.60		15.53	
July	16.40		15.40		15.40	
August	16.09		14.89		15.16	
September	15.92		14 73		14.93	
October	15 90		14.05		14.88	
November	15.84		14 26		14.78	
December	15.90		14.15		14 65	
Year	$17.10		$15.65		$15 83	

STOCK QUOTATIONS

COLO. SPRINGS May 9

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01⅜
C. K. & N.	‡ 14
Doctor Jack Pot	.05
Elkton Con.	.52½
El Paso	47½
Findlay	‡.05
Gold Dollar	.10½
Gold Sovereign	.02
Isabella	.09½
Jack Pot	‡.05
Jennie Sample	.09
Lexington	‡ 01
Moon Anchor	.02½
Old Gold	‡ 03
Mary McKinney	.31½
Pharmacist	.01½
Portland	.90
Vindicator	.74½
Work	.02

SALT LAKE May 9

Name of Comp.	Bid.
Beck Tunnel	.25½
Black Jack	.15
Carisa	.18
Cedar Talisman	.04½
Colorado Mining	
Columbus Con	.46
Daly Judge	‡4.45
Grand Central	.77
Iron Blossom	1 17½
Little Bell	.40
Lower Mammoth	.10
Mason Valley	.8
May Day	.15
Nevada Hills	3
New York	‡.13
Prince Con	
Silver King Coal'n	1.60
Sioux Con	.36
Uncle Sam	.68
Yankee	15

TORONTO May 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.50	Dome Exten	.54½
Hudson Bay	.93	Pearl Lake	.53
Temiskaming	.70½	Dobie	3.55
Wettlaufer-Lor	95	West Dome	2 50
Hollinger	12.65	Standard	.24
Preston E. D	.38½	Apex	19
Porcu. Gold	60⅜	Canada	1 12
Porcu. Tisdale	.14	Crown Char	‡ 52
Imperial	21	Coronation	37½
Central	73	Swastika	53½

SAN FRANCISCO. May 9.

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.08	Belmont	6.17½
Belcher	.47	Jim Butler	.27
Best & Belcher	.39	MacNamara	.12
Caledonia	.55	Midway	.20
Challenge Con	.28	Mont.-Tonopah	.80
Chollar	.23	North Star	.13
Confidence	.97	West End Con	.57
Con. Virginia	1.45	Atlanta	.11
Crown Point	.80	Booth	.07
Gould & Curry	.36	C.O.D. Con	.08
Hale & Norcross	.38	Comb. Frac	.08
Mexican	5 77½	Jumbo Extension	.29
Occidental	.70	Oro	.04
Ophir	2.10	Silver Pick	.04
Overman	.40	St. Ives	‡.16
Potosi	.44	Tramps Con	.02
Savage	.42	Argonaut	‡1.70
Sierra Nevada	.83	Bunker Hill	‡7 12
Union Con	2	Cent. Eureka	1.27
Yellow Jacket	.70	So. Eureka	7 50

N. Y. EXCH. May 9

Name of Comp.	Clg.
Amalgamated	63
Am. Agri. Chem	56½
Am.Sm.&Ref.,com	74¼
Am. Sm.& Ref., pf.	105¾
Anaconda	37⅛
Batopilas Min	2
BethlehemSteelpf	60¾
Chino	24⅝
Comstock Tunnel	.28
Federal M.& S., pf.	61½
Goldfield Con	6⅛
Great Nor., ore ctf.	59½
Homestake	86
Miami Copper	20½
Nat'nalLead,com.	52¾
National Lead, pf.	106⅞
Nev. Consol	18¾
Pittsburg Coal, pf.	77⅞
Ray Con	17¾
RepublicI&S,com.	30½
Republic I & S, pf.	93¾
SlossSheffi'd,com.	50¾
Sloss Sheffield, pf.	‡112
Tennessee Copper	36½
Utah Copper	44⅞
U. S. Steel, com.	74¾
U. S. Steel, pf.	118¾
Va. Car. Chem	60

N. Y. CURB May 9

Name of Comp.	Clg.
Ariz.-Cananea	‡3⅜
Barnes King	.15
Braden Copper	31⅞
B. C. Copper	5⅛
Buffalo Mines	2.20
Butte Coalition	16¾
Calumet & Mont.	‡ 20
Cobalt Central	.05
Con. Ariz. Sm.	1⅝
Davis-Daly	1⅛
Ely Con	5/16
Florence	1⅞
Giroux	6
Greene Cananea	6
Greenwater	‡.06
Guanajuato	3⅛
Guerrero	‡1⅛
Guggen. Exp.	190
Inspiration	‡7⅜
Internat. S. & R.	‡124
Kerr Lake	6⅛
La Rose	4⅝
McKinley-Dar-Sa.	11⅞
Min. Co. of A. new	5⅜
Moneta Porc	23
Mont Shoshone	‡.04
Nev. Utah M. & S.	¾
Nipissing Mines	10⅝
Ohio Copper	1⅝
Pacific Sm. & M.	7/32
Precious Metals	¼
Ray Central	1⅜
Red Warrior	‡1⅛
South Utah M.& S.	‡1/16
Standard Oil	672
Stewart	‡1⅝
Tonopah	6⅛
Tonopah Ex	1
Tri-Bullion	1/16
Tularosa	‡⅛
Union Mines	¼
Yukon Gold	3⅞

LONDON May 10

Name of Com.	Clg.
Camp Bird	£1 13s 6d
Dolores	1 10 0
El Oro	1 4 6
Esperanza	1 12 6
Mexico Mines	7 13 9
Oroville	0 6 0
Stratton'sInd.	0 2 3
Tomboy	0 15 6

BOSTON EXCH. May 9

Name of Comp.	Clg.
Adventure	5½
Algomah	7⅛
Allouez	30
Am. Zinc	24¾
Arcadian	‡2¼
Arizona Com	15¼
Atlantic	5½
Bonanza	.50
Boston & Corbin	12
Butte & Balak	5¾
Calumet & Ariz	50
Calumet & Hecla	467
Centennial	12
Con. Mercur	.05
Copper Range	60½
Daly-West	4⅜
East Butte	11½
Franklin	9½
Granby	33½
Hancock	22½
Hedley Gold	15
Helvetia	1⅛
Indiana	12
Isle Royale	‡14½
Keweenaw	2
Lake	32½
La Salle	3⅞
Mass	5⅜
Michigan	2⅛
Mohawk	38
New Arcadian	3¼
North Butte	28
North Lake	6
Ojibway	6⅛
Old Dominion	39½
Osceola	102
Parrot	11
Quincy	70
Shannon	10
Shattuck-Ariz	18⅛
Superior	32
Superior & Bost.	3¾
Superior & Pitts.	14⅜
Tamarack	35
Trinity	3¾
U. S. Smelting	34¼
U. S. Smelt'g, pf.	46
Utah Apex	2¼
Utah Con	14
Victoria	1⅜
Winona	6¼
Wolverine	108
Wyandot	1¼

BOSTON CURB May 9

Name of Comp.	Last
Ahmeek	165
Bingham Mines	1½
Boston Ely	1½
Boswyocolo	.08
Cactus	.12
Calaveras	2
Champion	‡.01
Chief Cons	1½
Corbin	3
Cortez	1⅜
Crown Reserve	3½
First Nat. Cop.	1⅝
Live Oak	17½
Mackinaw	‡.02
Majestic	41
Nat'l Mine & Ex.	‡.02
Nevada-Douglas	‡2
Oneco	1¾
Raven Copper	‡ 20
Rhode Island Coal	2½
San Antonio	‡3½
South Lake	5½
Trethewey	1⅞
Tuolumne Copper	‡4½
United Zinc, pfd.	‡2
Vulture	5
Yuma	‡.02

‡Last quotation.